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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Royle's Repeater for Jacquard Cards.

We here present to our readers an engraving of Royle's repeater for Jacquard cards, a machine ingeniously devised to perform important functions in accelerating an operation of silk manufacture.

The beautiful patterns and figures that render so many silk textures wonderful triumphs of artistic design, are worked into the web by varied manipulations of a complex warp. The changing of the individual threads, which by arrangement of position in the fabric produce flowers, brocades, and other attractive figures, is done by needles or steel spindles whose movements are regulated by perforated cards, Jacquard cards, so called from the name of the inventor, a Frenchman who lived last century. To produce the recurring patterns, a succession of these cards sometimes numbering two or three thousand is laced together and revolve over a prismatic box giving in their turn the required movement of raising the warp threads into action.

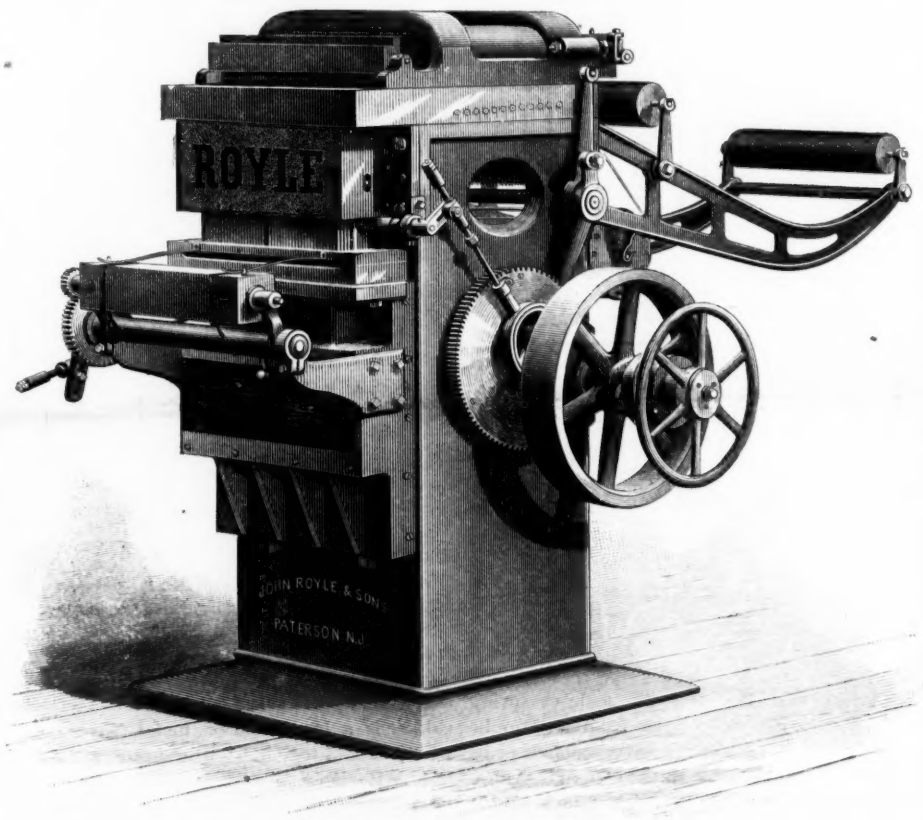
The cards for a new pattern are perforated by hand in what is known as a piano or key machine. After the first chain of cards is produced, it becomes of the first importance to be able to duplicate or "repeat" them quickly as often as a manufacturer desires to start a large number of looms upon a pattern of goods. To do this work of repeating pattern cards is the purpose of the machine which we represent in this engraving, it being the first ever built for this purpose.

The perforating of the cards is performed by a vertical reciprocating die and set of punches, each capable of being pushed upwards when such movement is not prevented. Cards vary in size up to 600 holes, which is the largest used. The cards to be duplicated are arranged upon the extending card-race arms in the same manner as upon a loom. The uncut cards, having been previously laced together, are passed forward through the machine and delivered finished, every motion of the die cutting clearly into each card the requisite number of perforations, the movements of the punches having been regulated by the holes in the pattern cards, which in their turn are guided by what is called a pattern cylinder.

The construction of the machine is such that it is automatic in all its motions, and an abundance of power and strength is secured to easily do the heaviest cutting required. The carriage of the pattern cylinder is mounted directly on the top of the machine, so that it can be readily lifted off for access to the parts below, and it is provided with a removable hood which may be raised for inspection of the needles which regulate the motion of the punches. These punches are worked by an adjustable eccentric, which is made to compensate for loss of motion. The feed is regulated by a small crank connected with a plate, which equally divides each circuit into four parts.

Long bearings, large wearing surfaces and carefully selected mechanical motions, constitute the prominent and durable features of the machine. As it is well known that the punching of a great number of holes simultaneously requires enormous pressure even where the material is thick card-board; to mitigate the shocks on the machine that would be produced by all the punches going through together, an ingenious arrangement has been made which causes them to strike the surface in close succession, thereby greatly reducing the strain.

The workmanship is of excellent quality and the materials are of the best kind, steel being used in every necessary point. As this is a pioneer American machine it attracts much attention, and the makers seem to have made a special effort to produce something highly creditable. The manufacturers and patentees are Messrs. John Royle & Sons, Paterson, N. J.



REPEATER FOR JACQUARD CARDS.

Where the graduate of a technical school dons overalls and learns the trade, he is soon found going upwards in the mechanical world. But that is an exceedingly rare practice with technical school graduates. They unfortunately too often come out of these schools with the impression that they have nothing to learn, and failing to obtain the position of superintendent of a machine shop or master mechanic of a railroad, the places they conceive their merits entitled to, they drift towards the position of draughtsmen. The consequence is, that this business is being overcrowded just the same as every other specially-deemed genteel vocation, that can be learned and pursued without the soiling of hands, is becoming over supplied. The preference for the technical school before the machine shop, arises in a great many cases from the fact, that it is clean and so called genteel. It is curious to watch the struggles and subterfuges that are going on around us, to achieve great deeds without labor, to acquire skill without industry. People who have to work their way in the world, are better to learn in the start, that there is no royal road to knowledge. Labor and perseverance are as necessary for the success of the rising generation as they were for their grandfathers, and the sooner they are told that lesson plainly the better it will be for all concerned.

There is something amusing about the different capabilities for making noise which different locomotives develop. When a locomotive is in first-class condition, properly proportioned and put together in sound workmanlike manner; when all the working parts are in good shape, every rubbing surface lubricated, every bolt and brace tight, the only noises which ought to be heard in running are the beats of the exhaust steam and the vibrations of the wheels rolling on the rails or striking the joints. Beyond these sounds every noise is a discord. But discords are no exception in the oratorio of engine running, for in many instances they are the rule instead of the exception. Some engines resemble men in their capacity for noise. It is not that they are in bad order that they rattle, and tumble, and jar everything that is near them. Engines of this kind get comparatively smooth and quiet as they work loose. Others again, that have been debarred from their long-earned goal, the scrap heap, seem to be making loud complaint of the usage they are getting, and pass through the peaceful country like a moving boiler shop with riveters working full time.

Henry Parsons, superintendent of the works of the United States Electric Lighting Co. at Newark, N. J., has resigned his position to accept that of superintendent of the Passaic Machine Works, Watts, Campbell & Co., in the same city. Mr. Parsons was formerly connected with the Passaic Works.

Extracts from Chordal's Letters.

LOOSE FITS ON A MACHINE TOOL—AN ENGLISH MECHANIC'S CRITICISM—MEASURING LOOSE FITS—GAUGES FOR ILLUSTRATING THE VALUE OF SMALL DIMENSIONS—HOME-MADE MACHINISTS' TOOLS—STEALING SMALL TOOLS—CHORDAL'S LETTER E—SLIDING GAUGES—DOUBLE AND TRIPLE CALIPERS—THE MICROMETER CALIPER.

Mr. Editor:

* * * Two or three weeks ago I wrote you in regard to a certain British machine then being set up in a certain American machine shop, calling your special attention to the remarkable looseness of some of the fits. I have heard considerable lately of this part of my late letter, and I feel called upon to make certain explanations—something I rarely take the trouble to do in these elegant "extracts."

First and foremost, my remarks were not intended to, and, in fact, did not criticise the character of these fits. I simply called attention to the fact, and gave, on my own account, some reasons in defense of such loose construction. I did not say these fits were due to bad workmanship. But I should have gone further and stated that in my opinion, judging from the appearance of things, the loose fits were simply the carrying out of a predetermined policy. These fits were loose, and they were undoubtedly intended to be loose.

Again, I said some of the running fits were a 32d of an inch loose; and I know enough about sizes not to misconstrue a 100th of an inch into a 32d. I have again looked at some of these fits, and found that some shafts were loose in their journals very much more than a 32d.

And again, I want to explain that this machine is not a lathe. It is a special tool for doing accurate work in machine construction, and I believe the machine will do what it was intended for.

I noticed that some of the fits in this machine, in places where a fit seemed to be really needed, were got up in good solid style; there was no nonsense about them. With all the peculiarity of fits, I believe the looseness will be found where tightness will do most harm, and that none will be found where looseness would do harm. But still the construction was a revelation to me, as I have never seen any work of its character done on any tool designed for metal cutting.

* * * Yesterday I received a letter from an English mechanic in this country, who wrote as follows: "Your remarks in regard to the loose fits of that English machine show that you have been caught in the same trap which caught me a very short time ago. You have formed a wrong conception of a small dimension. The upright spindle of my governor—the arrangement which revolves the gears and balls—seemed to dance around considerably, and I judged it was a 16th of an inch loose in its hole; so I took the governor off, and told our foreman to fit a new spindle, and fit it properly. When he got it done I shook it some and told him it was still too loose. The foreman said, 'How much?' and I said a 32d of an inch. The foreman took issue with me, and we had a fine workman hammer out a wedge of brass

to drive into the crack. We then measured the wedge where it went in, and behold! it was less than a 64th of an inch."

* * * Many months ago I wrote you of a set of gauges made for me by the Pratt & Whitney Company, to illustrate the value of the small dimensions which machinists were working to every day without knowing it. There was a ring with an accurate half-inch hole in it; there was a half-inch plug which just fitted the hole. There was another plug 1000th of an inch smaller, and there was another plug 100th of an inch smaller. The average machinist inspecting these fits would call the thousandth plug a 64th of an inch loose, and the hundredth plug they would rate all the way from a 32d to a 16th loose. I wish my governor friend could get hold of these plugs a while; and I believe it would do his foreman a little good, too. From his letter one can see at once that this brass wedge business is the nearest approach to accuracy they could think of. I don't know how they measured the wedge, but expect they sighted it against a steel rule. They could see that it was not a 64th of an inch, but could not say just how much it was.

There are lots of lathesmen who could give you the looseness of that governor fit in quarter-thousandths of an inch, and they have the tools right in their tool boxes for measuring it; and they use them, too.

* * * Machinists are always hankering after nice little tools, and I have often wondered why in the world they don't have them. A fellow will go to work on a 4-inch try-square with the best of intentions, perhaps, to have the finest square that the eyes of man ever beheld—something better than the squares you buy, you know; something worth having. He works about thirty noons on this thing, and a few nights and a little on Sunday, and takes a half holiday to finish it; and when it is done it is simply a very awkward, common tool which no man of judgment would willingly pay him 75 cents for. It is as square inside as he can file it, and it is as square outside as he can file it; but it is not particularly square in any other way. The finish is decidedly bad, and in many places has destroyed the accuracy of the rougher filling. If the man is silly, he will be proud of this square, and will carry it away from the shop in his pocket for two or three weeks, in order to exhibit it evenings to men working in other shops. And then he will cut some fancy notches in his tool-box to hold the thing, and it will be some months before he will become fully aware of how common a job this square really is. If he is a tolerably sensible man, he will begin to slouch it when it is about half done, and finally get disgusted and give it to some apprentice boy as a keepsake. If he is a really sensible man, he will quit making it before he ever thinks of beginning it, and will buy a decent hardened square with a day's wages. It will be square any way you take it.

* * * A home-made straight-edge is another abomination. It is ugly and crooked—two fatal qualities in a straight-edge.

* * * Speaking of these small tools naturally reminds one of the eternal stealing of these small tools. Ten men come and ten men go, and you lose a pair of calipers or a square or a scale or something, and that is the last of it. You cannot suspect any particular man of the ten; you can only suspect them all; nine honest machinists suffer for the failings of one. You can never get on the track of these tools again, because the man who steals tools never brings them to light until he is at work in some far-distant shop. Tools generally have names stamped on them, and one peculiarity of the tool thief is that he leaves this name on and stamps his own on in addition.

* * * Of all the tool thefts I have ever heard of, I never heard of but one recovery. Dix's universal square was gone. He centered his suspicions upon one ugly chap lately bounced. The man was traced to a near locality, and Dix wrote him a note to return the square in 24 hours or he would call on him with a constable and warrant. The square turned up promptly on time.

* * * These little tools are not of sufficient value to justify advertising or the prosecution of the thief if found. I don't know that the plan has ever been tried, but I for one am willing to see how it will work—and right now.

I had a steel square with a very thin ringing blade about 12″ long and 1½″ wide, the head was very heavy; I should say ¾″ thick, 1⅝′ wide and 8″ long. The tool was not extra well finished and the blade showed some spots of black rust which the finish had never taken out. This tool was a borrowed one, and had stamped upon it the name of J. D. Barlow. It was stolen from me, along with everything in my tool-box, about six years ago, and some graceless scamp has got it now. I will pay $10 for information which will lead me to the discovery of the dishonest possessor of this square, and I will ask you, Mr. Editor, to forward the correspondence.

* * * I don't want this square; I would not give $2 for it if I did. And Barlow never expects to see it again. And I would not spend 10 cents prosecuting the fellow who stole it, but if I can find out who he is I will give one tool thief a brief notice in the columns of the AMERICAN MACHINIST which he can put among his traveling testimonials.

In order to make the act of tool stealing odious, it is necessary first to find out who the thief is and let his name be known throughout the country.

* * * I will see how my square business will turn out, and in the meantime I would suggest that the first 3″ scale or spring calipers known to be stolen from a shop be made the subject of an advertisement to be paid for generally by all the men in the shop. If this was done a few times things might get so that a man would not dare to make use of a tool that he had stolen, providing it could be identified.

One misfortune about the thing is that it is easy to file marks off a tool, and the only hope is that this fresh filing on an old tool will show that something of the kind has been done and, may be, lead to the exact identification.

* * * I once had stolen from my tool-box a set of steel letters and figures. The letter E had got broken, and I made a new one, and it was a terrible looking letter E. I would recognize its impression if I should find it on the obelisk. Three years after these letters were stolen I was at work on a lathe 300 miles distant, and on top of the tail-stock I found the name William Elwood Wesley stamped out in full; and lo! it had been stamped with my stolen letters. Inquiry showed that Mr. Wesley was dead, and I suppose these stamps have fallen to his heirs.

* * * To return to the little tools: the average machinist always insists on making his own inside and outside calipers. It takes a good deal of time to make a pair of 9″ inside calipers, and they are never a really creditable job; no such tools as our machinists ought to have, but they are all right as calipers; they are true on the joints, and the points are all right, and they will go into a small deep hole, and all such as that. But, still, there is that peculiar home-made ugliness about them which is not a matter to be proud of.

But the real truth is that no good tools of this kind have ever been offered for sale. There are plenty of calipers to be had, but they are terribly rough, cheap, soft and shiny. It is lucky for the machinist that he don't know how to get sheet steel as soft as these manufacturers do; six months' knocking would batter up the edges considerably. The trouble is machinists are silly about their money in buying these things. They may not save any of their money, but, still, they will not spend some of it for good tools. A pair of 8″ inside calipers is sold for about $1, and really good ones cannot well be sold for less than $5. The machinist instead of creating a demand for the good $5 calipers will do $10 worth of fussing on an indifferent pair.

* * * Spring calipers I consider a perfectly made tool for their purpose, but have never looked upon them as taking the place of riveted calipers.

* * * Fancy calipers are an abomination, mechanically and morally. A woman's leg as a model for a pair of calipers is bad—and that is all that can be said of it.

* * * Aside from the morality or immorality of the thing, a thing which I would not criticise on decency's account in this connection, the same remarks would apply to outside calipers having an OG form. The OG caliper is a big waste of metal, as a pair which should take in 6″ would quit working at 4″. Registering calipers, with a pointer to them working in connection with a graduated arm, are things to be let alone. They do not give the size close enough to pick out rough iron after slight use, and can hardly be made to do so.

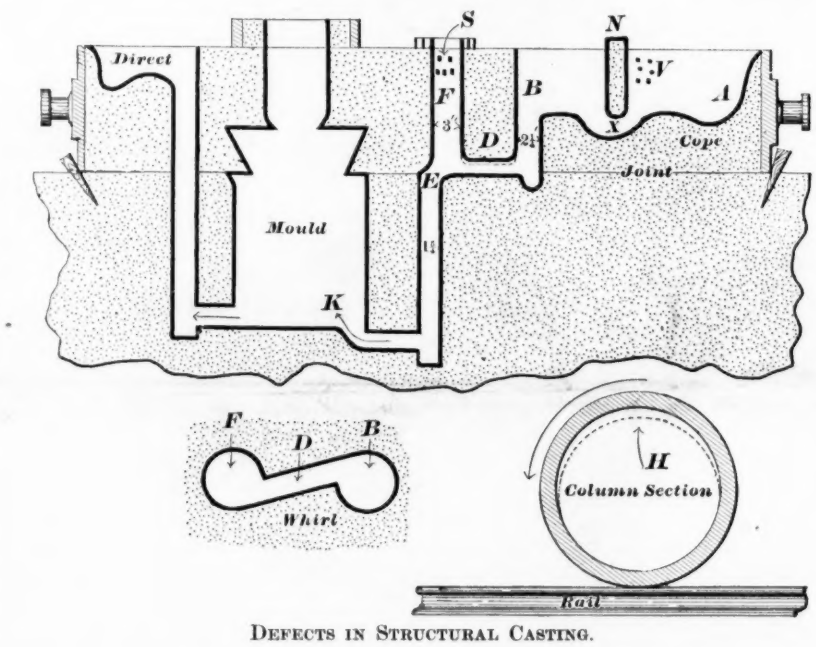
* * * I believe if visemen would get to using sliding gauges more they would like them better. These tools are really but little known, but I probably ought not to mention them without drawing a picture to show what I am talking about. As now in the market they are most all graduated and provided with a fine adjusting screw. This brings the price up. If made hard and arranged to be set like any other calipers, I think they would be appreciated and purchased.

* * * If visemen only knew it, the blacksmith's double and triple calipers will furnish an excellent model from which to get up a very useful little tool for use around a vise, and also the lathe. If ugliness is sought after, copy the blacksmith's form exactly. If not, design them on the same principle. The blacksmith's caliper has a long handle to it so he won't burn himself, and this handle gives to the tool a peculiar shape, which has probably led machinists to believe they have no use for such a tool. It is one of those things that is not as bad as it looks.

* * * The simple little micrometer caliper, arranged with a screw to read to the thousandth of an inch or half a thousandth or closer, is a tool which more machinists ought to have. The moral effect of such a tool is excellent. But few of the machinists in this country ever saw one, or know what it is. These little tools are now for sale up to 2″ in size. If they cost a little something, it is so much more reason why a man should possess one.

* * * * Very respectfully,

CHORDAL.



DEFECTS IN STRUCTURAL CASTING.

Defects in Structural Casting.

BY THOS. D. WEST.

A PAPER READ BEFORE THE CIVIL ENGINEERS' CLUB OF CLEVELAND.

The value of sound castings in structural work is best comprehended by those who have suffered losses through their defects. Formulas and tables upon the limit of elasticity, compression and tensile strength of cast iron might often be called factors of faith; for, did the mechanical engineer know how low his factor of safety is brought through defectiveness, he could not help acknowledge that many massive structures are built more by faith than by facts. And while there are a great number of well ascertained facts and definite laws for the guidance of those engaged in construction, there are often defects caused through ill manipulation and designs that would seem to make structural formulas and tables but a starting point for guess-work. In the investigation of cast iron structural or machine accidents, it is rarely the case that the work is found imperfect in its design. The verdict generally given is, defective material or poor workmanship. Castings for structural and machine building, where an injury to them would be liable to cause the loss of life and property, are as a class what engineers are required to deal with, and often to stake their reputation and welfare upon. As a chain is no stronger than its weakest link, so is a casting no stronger than its weakest part. Almost every casting made is weaker in some parts than in others, not necessarily so through design, but often through natural causes that in some cases might be avoided through the aid of practical experience and skill.

Heretofore foundries have generally been looked upon as nothing but dumping holes for blockheads, dirt, and pig iron. There is no question but that we have them all; but I can safely assert that in many of them there is labor done that is worthy the study of our brightest engineers. Because work is dirty, it is no sign that a thick and muddy brain can do it, or that there is no field for thought or study.

The defects in castings are due to many causes, some of which are generated outside as well as upon the inside of foundry walls. Those outside could be classed under the head of *design* and *competition;* inside, under the head of manipulations of *mould* and *metal*. Competition is often detrimental to the production of sound structural castings, for the simple reason that the work is taken too cheaply, thereby not allowing the lowest bidder enough margin for good material and labor. In this may be seen one of the reasons why the engineer should familiarize himself with the workings of a foundry, in order that he may be able to correctly judge what different classes of castings are worth in dollars and cents to manufacture. As a general thing, structural castings cheaply bought are cheaply made, and may answer for a time; but their steady employment will sooner or later result in ruin and disaster.

With reference to the designing of structural castings, the draughtsman's and pattern-maker's work is often a large factor in the producing of them clean and sound. This subject can better be taken up and understood by the following discussion of mould and metal:

Every structural casting contains more or less dirt. This dirt comes from the mould's surfaces and the metal's impurities. The amount of dirt a filling mould will collect depends mainly upon three things, the first

being the moulder's ability to properly make a mould; the second the shape and size of the mould, and the third the style and manner in which the mould is gated and poured. The injury to a casting from dirt depends upon the amount of dirt, and where it is lodged. There are some castings in which certain portions can contain more or less dirt, and still it will not materially impair their strength for the purpose for which they are intended. The best judge of such defects should be the engineer himself. Now, if this be the fact, it does seem but a step further for the engineer to acquaint himself with the practical moulding of any special piece or pieces, and cause arrangements to be provided for assisting the moulder in catching and holding the dirt where little or no injury would result therefrom.

It would be impossible to here give data that could be used as a standard for the procuring of every casting clean and sound, as what might work well in one case would seldom do for another. However, there are two or three points that, if explained, will show principles that might often be applied to greatly assist in making castings, and also give to the novice an idea of means used for collecting the impurities of the metal before it enters the mould. In pouring a mould, the tendency of all dirt or material of a specific gravity lighter than the iron is to float, or rise toward the surface of the metal. This fact is often taken advantage of by what foundrymen call a skimming gate. To show the form of this gate, and to assist in explaining the principle of its operation, the accompanying sketch (page 2) is given:

At *A* is what is commonly called a basin. Into this the iron is poured, and the basin filled as soon as possible. At *K* the arrow represents the metal flowing into the mould. Now, it is very evident that, keeping the basin full, the metal in the riser *F* will be about on a level with that in the basin. The iron that runs into the mould being taken from the bottom of the liquid metal, as represented at *E*, it must necessarily be free of impurities that by reason of gravity have risen to the surface, as shown at *D* and *S*. While this explanation is only to give an idea of the principle, it might be well to state that the same principle is used in a variety of forms, to suit different moulds and conditions. The value of skimming gates is often lost through the moulder not using judgment in making the gates or runners, *B*, *F* and *E*, in proper relation to each other. *F* should always be the largest, in order to have room for dirt to rise. *B* should be larger than that shown below *E*. If *E* were larger than *B*, it would be a difficult matter to keep the dirt from passing into the mould, for the simple reason that *E* would take iron faster than *B*, thereby not allowing the basin and heads to be kept full, which must be done, in order to collect and hold the impurities as shown. Keeping the riser *F* full will by no means be a guarantee that the impurities are being collected. The flow of metal may be so fast that the dirt will not be held. The point to be kept in view is, the longer the metal can be kept in *F* and *D*, before passing into the mould, the more it should be purified. The gates or runners, *B*, *F* and *E*, are supposed to be round, and the sizes shown represent about what relation to each other skimming gates should bear. The sketch marked "Whirl" shows one of the wrinkles sometimes used. The connection *D*, if cut from *B* to *F*, in the manner shown, will cause the metal to whirl in *F*, thereby causing the impurities to rise, as shown at *S*. The greater the whirl the better the results. Another plan sometimes practiced to catch and hold impurities from going into a mould is shown at *N*. This is commonly called a skimming core. It is built or set into the main basin from 2″ to 6″ lower than the reservoir bottom. Below this core is a basin, as shown at *X*. When this basin is filled with metal, the dirt is held as at *V*, and the clean iron flows through at *X*. The amount of dirt or the impurities that a well-contrived skimming gate or basin will gather, and keep from going into a casting, is often remarkable. The section marked "Direct" shows the method ordinarily practiced, in which there is nothing to prevent the dirt or impurities from passing into the mould, except what is held up by keeping the basin full of metal while pouring. I should like to have here treated upon other forms of gates and runners in their relation to special forms of castings; but as my time to prepare even what I have prepared was very short, I shall have to dispense with much that should be brought out in order to fully discuss the subject, as implied by the title. It is not intended to convey the impression that by having a well-formed skimming gate the casting is sure to be free from defects. In some cases where the making of the moulds is in the hands of a first-class moulder it might be so; but, as a general thing, the skimming gate is but a small factor; about all that can be said of it is, that it aids in collecting the impurities of the iron.

There are other things the engineer will need to be even more careful about than dirt and impurities. These are scabs, blowholes, cold shuts, misplaced cores, improper feeding, &c. Any one of these may hide a defect that will reduce the strength of a casting to one-twelfth of what should be its ultimate working load, and may even greatly exceed that. Such defects cannot be bridled with mathematics of any kind. They are infinite, treacherous, and beyond human reason to define. A scab is part of the mould's surface flaked off, the depth of which varies from $\frac{1}{16}$″ up to 6″. When a scab is over 1″ in thickness there will generally be more or less visible blowing. Sometimes this mould or casting blowing will become so violent as to tear a mould in pieces, thereby making the exact form of the intended casting unrecognizable. Such defects as this will, as a general thing, leave but little doubt as to the casting's future use; they being too apparent to deceive must necessarily introduce it to the scrap pile.

When a mould scabs, the sand mingles with the iron, and some of it may be visible while some may not. The sand being specifically lighter than iron, it naturally rises until stopped by contact with cores, or rises to the surface. This is a point in designing castings that should be remembered, as with this in mind the sections that are liable to confine or catch dirt might often be made thicker than the design would call for, thereby allowing for a reduction in strength. To further convey this idea, I would call your attention to the sketch of a column section. As a general thing—in fact I never saw or heard differently—columns are wanted of an even thickness all around.

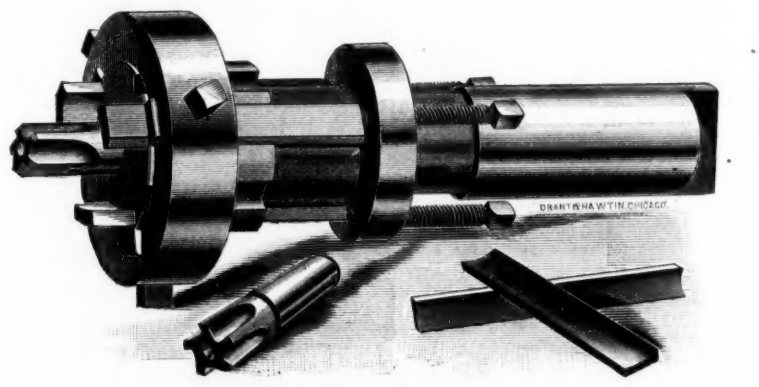
I remember some twenty years back of inspectors testing a lot of columns—they might have been pipes, but whether so or not the principle involved is the same. The shop where the inspection or testing occurred was at the Portland (Me.) Locomotive Company's Works Foundry.

In testing these castings two rails were placed parallel, and after being leveled, the castings were raised one at a time and set upon them. The inspectors would then rotate them over about one-half their circumference, and after coming to a stand they would then be allowed to find their own position.

By this process any unevenness of thickness was quickly detected, and if any of the castings in revolving to their position went faster than the allowed speed, they were condemned. To the best of my memory the castings were made in green sand and cast horizontally.

Now, the question in my mind is, was not the test somewhat in error? In the horizontal casting of any cylindrical-shaped mould the cope or top part of the casting cannot be as sound as the sides or bottom, for the reason that it contains more dirt than any other portion of the casting. I think it is a safe assertion to make, that if a horizontal cast pipe or column that was found to stay in equilibrium at any point when being tested upon rails, was given an even internal tension, or end compression strain, until it burst or was ruptured, the point of first fracture would be the cope part of the casting. I would like to hear of such tests being made, for I do think it would result in opening the minds of many to an important factor in the casting of structural work, which is as follows: where it is reasonable to expect dirt, *make that section thicker or heavier than the proportion calls for, in order to counterbalance the weakening effect caused through the mingling of dirt and impurities with the iron.*

As regards the question of how much thicker the top cope section of pipes or columns, as shown at *H*, should be as compared with the sides and bottom, it would be rather difficult to answer, as it would depend greatly upon the combination of lengths, diameter and thickness, and also upon the facilities for moulding. However, I would say that with a 12 inch column or pipe of average thickness and length, one quarter of its thickness, added to the cope, as represented at *H* would not always be a guaranty of its holding its own in a testing machine.



Flue Hole Cutter.

In structural castings the question of proper proportions, shrinkage of metal and its quality are three very important elements that require careful consideration, but as my limited time will not allow me to do full justice to the discussion of them, I will close with the remark: That to figure for strength in castings is one thing, and to know that you will obtain it is quite another. The former is the work of rules and tables, the latter a matter of observation, investigation and practical experience.

At the conclusion of the reading of the paper it was discussed by Messrs. Holloway, Walker, Gobeille, Bowler, Getchell and others. Mr. Getchell was acquainted with the circumstances of the tests referred to by Mr. West. The pieces were pipes, cast horizontally, and about one-third of them were condemned.

The *Nautical Gazette*, in describing the break-down of the steamship Aurania, which was noticed at length in the American Machinist of July 28, after personal examination of the engine, says that the rod which broke was *thirty feet long and thirteen inches in diameter*, and repeats the opinion of an officer of the ship that, had the steam been at the bottom of the cylinder instead of the top when the accident happened, there would have been no Aurania left! If the steam was not at the bottom of the cylinder, what drove the piston up through the tophead? The *Nautical Gazette* makes this accident to the Aurania the text for violent abuse of British mechanical work and shipbuilding. It is our belief that American shipbuilding interests are not well served by this method of treatment on the part of journals aiming to advance them. Giving fair credit to the British manufacturer for what he does that is good, and thereby stimulating the American builder to do better, is both more sensible and more useful. While we are as anxious as any publication can be to see American shops and American yards providing machinery and ships for our share of maritime business, we are far from being disposed to cry incompetency because an accident has happened, and we think our contemporaries should show equal forbearance. The fracture of the Aurania's main connecting rod on the first voyage was a very unfortunate accident, but we do not consider it without parallel. Crank shafts, main shafts, bridge girders, rails, and other constructive material have given out before in the hands of our most competent American engineers; so it displays bad taste to exhibit a feeling of triumph over the misfortune even of our rivals.

A brilliant attempt is being made by an Illinois patentee, to banish the bell punch and other incitements to honesty, and make the passenger himself record the number of miles he has traveled. To quote from the description of the patent: "Pressure upon a seat throws into gear a reciprocating gear head which at each backward movement unlocks a spring dog, which actuates the register as it swings over the dog. Dog is immediately afterwards forced down and locked, ready to be again released by reciprocating head." This dog is one of a species that never sleeps, and if the patentee can extend its usefulness a little, the success of the animal will be assured. It must be made to grab the leg of the man who twists himself round two seats and intrudes his muddy feet into the aisle; it ought to waken the man who snores in the sleeper louder than the shriek of the locomotive whistle; it should be taught to look after the butcher of the train, and its usefulness would be more extensive if it will bark at the nervous man who insists on keeping the window open for ventilation, so that the smoke and cinders will have free access to the throats of the other passengers. If an inventor wishes to get up an automatic dog whose usefulness will be properly appreciated, he must not overlook these cases where its restraining power will prove of greatest service. And he must reconsider his plan of locking up the dog. An animal of this importance must be above restraint.

New Flue-Hole Cutter.

Herewith we publish the engraving of the "Jewel" Hole Cutter, a tool designed principally as a flue-hole cutter, but which will also be found useful for cutting smooth and true holes in safe plates, vault doors, and similar iron and steel plates. In fact it will meet, as intended, many requirements of boiler-maker and machinist work that have formerly been done by indifferent tools at the expense of time and accuracy.

The body of the tool is a forging of machinery steel, the head is case-hardened, and the cutters, with the set screws and gibs are of best English tool steel. The shank is flattened at the end, and has sufficient stock to be fitted to the socket of any press required for its work. The cutters are curved to conform to the work with any diameter of the tool and properly cleared to cut free. They can be kept sharp by grinding, are 4″ long, and can easily be set by means of a screw to cut through iron or steel plates as heavy as one inch thick. Lead pins, cutters, and set screws are all made to interchangeable sizes, and are kept on hand by the maker. Special steel liners are furnished along with this tool, to be used under the cutter in cases where flues or tubes run lumpy or irregular in size. Using these liners provides for this trouble, and increases the hole sufficiently to enter the tube, doing away with the reaming and sizing operation. One of the guide grooves, which is a feature of the tool, carries a thin blade or cutter for countersinking when that is required.

This tool is made by the Myers Manufacturing Company, 307 S. Canal street, Chicago.

Locomotive Notes.

CONSERVATISM IN LOCOMOTIVE BUILDING—COMPOUND LOCOMOTIVES—INDICATIONS OF CHANGES IN LOCOMOTIVE CONSTRUCTION.

BY ANGUS SINCLAIR.

In examining the array of locomotives, old and new, that was to be seen at the Chicago Exposition, a reflective observer could not fail to be forcibly struck with the small amount of progress that had been made in fifty years. Almost the only advance perceptible was towards increase of size and improvement in material and proportions. Viewed in the light of what has been done in other branches of steam engineering, locomotive practice appears conservative in an extraordinary degree.

Stationary engines have been elaborated in the search for enhanced economy, and results reached that would have seemed fabulous thirty years ago, and improvements in marine engines during the same period have reduced coal bills from 50 to 75 per cent. Adjusting the proportions of locomotives has been productive of some economy, but it falls decidedly behind the proportional record of stationary and marine engines.

The existing type of locomotive is a difficult machine to experiment with, and radical changes of form entail such heavy expense, without any certainty of improved conditions, that most railroad companies have preferred to leave it alone. But the time seems approaching when the leave-alone policy will be abandoned. Competition keeps reducing transportation charges, which in turn requires decreased operating expenses. So the dissatisfaction with the performance of the ordinary locomotive keeps growing, and demands for better results are being uttered with no uncertain sound. A desire to meet the demand for cheapening transportation was first manifested by increasing the size of locomotives, but this tendency seems to have reached its limits. Something else must now be done.

The success which compound engines have met with in marine service has directed the eyes of some of our advanced master mechanics to the experiments going on in England and France with compound locomotives. The compound principle, which merely utilizes to its farthest practical extent the power of steam expansion, has been the subject of innumerable patents and inventions that date back away into last century; but none of them achieved decided success till certain Scotch shipbuilders adopted the compound engine for their transatlantic steamers about the year 1850. Since then this engine has grown rapidly into favor, and persevering efforts are being made to extend the same principle to locomotives, which has given so much satisfaction with marine engines.

Mallett, an eminent French engineer, has been working for about ten years with compound locomotives, and under his fostering care he claims that they yield 20 per cent. better results than the ordinary locomotives. Mallett uses two cylinders—a small high pressure cylinder on one side which exhausts into a large cylinder on the other side, which has double the piston area of the low pressure cylinder, both the cylinders being arranged to take live steam in starting a train. Webb, locomotive superintendent of the London and North-Western Railway of England, followed the lead of Mallett and built a compound engine with three cylinders, the low pressure cylinder being placed in the middle under the smoke-box and connected to a crank axle.

The radical alterations which these attempts at improvement imply, must be followed by very decided economical results before they will pay for the changes and the augmentation of repairs that always follow increased complication. It does not appear that the necessary gain has been proved. The fact that a locomotive, that is be ng specially watched and cared for, is making a better record than the ordinary undistinguished engine, is no proof of superior excellence. Put a new head-light on a locomotive and say that it will save 10 per cent. of fuel, then send a man out to keep close watch of the fuel and water used, and an *apparent* saving will in almost every case be effected. It is an intensely difficult matter to distinguish with exactitude what makes one locomotive use more fuel than another, for there are so many outside and inside conditions not seen or calculated that influence their action differently during trials. This difficulty seems to have been encountered and understood by Mallett and his assistants, for after a series of trials extending over two years with a compound and an ordinary locomotive, they were so dissatisfied with the result, that they placed the engines in a repair shop and ran them side by side as stationary engines. The only decision they seemed to arrive at beyond dispute was, that a steam jacket exercised an injurious effect upon the economical working of a locomotive, a somewhat extraordinary and unexpected conclusion.

We hardly think that the compound locomotive is going to make many converts in America, unless its merits develop much faster than they have done in the last five years. The indications are that improvements will be worked out by better and more effectual methods of combustion, so that less waste of heat will pass through the smoke-stack, and the steam will in certain cases be better utilized by changes in the valve gear, which will admit of more expansion within cylinders, and will not materially alter existing types. Without any revolution in the plan or arrangement of the locomotive, improvements may be made which will bring it near the level or stationary engines in point of economy.

So long as keeping the fire-box within the limit of frames placed inside the cylinders was recognized as a necessity, the means of extending the heating surface and grate area was very limited—too limited for economical combustion. That the mechanical world has broken away from this trammel, was sufficiently evident at the Exposition, by the attention which the Wootten locomotive received. Several models around the building showed that others had got beyond the frames, and Forney has patented a locomotive where the drivers are placed ahead of the fire-box, which can then be extended to any desired width, the overhanging weight being carried by the tank. This seems to be the direction inventors are working in for economical generation of steam. The Wootten engine, it is said, will make steam freely with a smoke-box temperature 100 degrees below the average of an ordinary locomotive, while pulling 20 loaded freight cars at a speed of 25 miles an hour on a level track. This is what comes of the ample fire-box surface, steam being made freely without continual forcing.

For fast-running engines increase of economical operation must be looked for principally in the improvement of the steam-generating parts. So far there are no signs of an invention that will supersede the link motion. Minor improvements may be effected by adoption of the Allen valve, or something similar, that will help to accelerate the passage of steam to and from the cylinders. Balanced valves may reduce existing loss from friction, which will be further diminished by more regular methods of lubrication; and in some instances the proportions of the motion may be better harmonized. To maintain a speed of fifty miles an hour, the steam is as well distributed by the link motion as it can be to perform the required work.

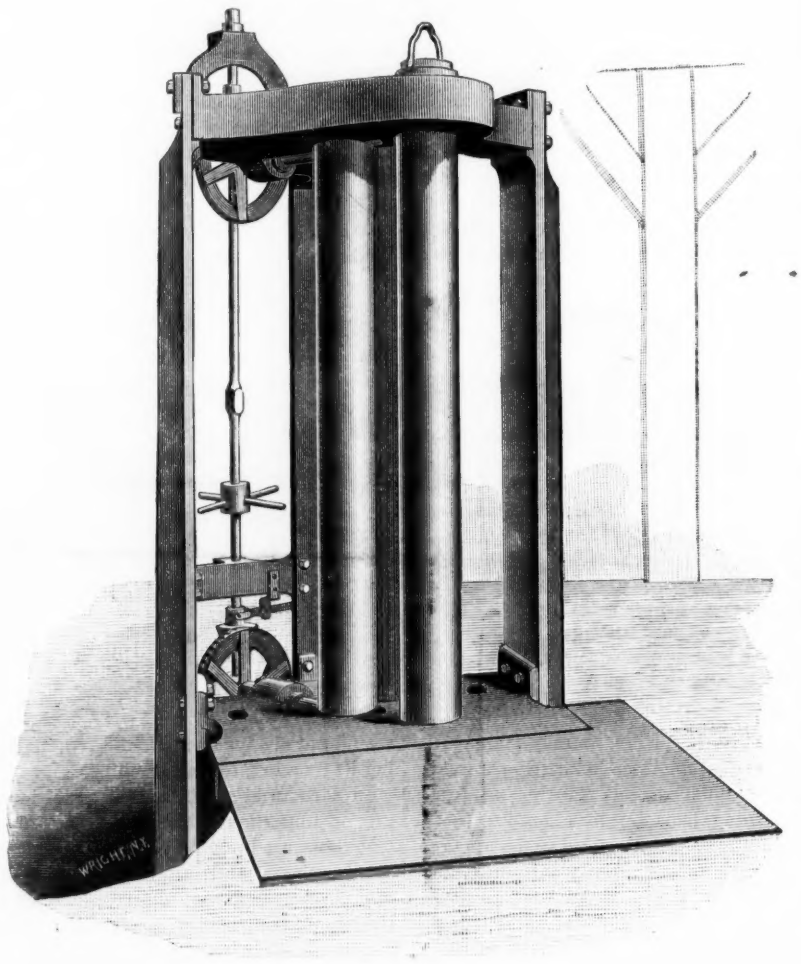


FIG. 2.

The case of slow-running and heavy-pulling locomotives is different. Greatly increased efficiency of steam work in the cylinders will probably be secured by using the Stevens valve motion, or some similar arrangement. A device which secures expansion during 75 per cent. of the stroke will obviate the demand for compounding of locomotives.

Vertical Plate-Bending Rolls.

We present on pages 4 and 5, engravings representing two views of the vertical plate-bending rolls built by Robert Kent, 45 Jay street, Brooklyn, N. Y.

As will be seen in Fig. 1, the rolls are driven by a worm and worm-wheel, by which a strong, steady motion is imparted. The movable roll is operated by means of the shaft shown with the hand wheel attached. This shaft carries bevel pinions at the top and bottom, which, by working in bevel wheels, move both ends of the roll alike. If it is desired to roll coned work, either the top or bottom pinion may be thrown out of gear.

In Fig. 2 the reverse side of the rolls is shown. The plate is fed in across the table, and when the rolling is completed, the roll shown with shackle attached is lifted and the shell removed. In lowering, this roll is guided to its place without changing any of the adjustments.

Trial of the Steam Yacht Siesta.

The report of Chief-Engineer B. F. Isherwood to the Bureau of Steam Engineering, on the trial of the steam yacht Siesta, has been published by the Navy Department. The Siesta was built for private parties by the Herreshoff Manufacturing Company, and has a length of 90 feet 4 inches on the water line, and a breadth of 15 feet 2 inches. Her engine is vertical, direct-acting, compound condensing, with cylinders 10½ and 18 inches diameter, both pistons having a stroke of 18 inches.

The main valves are worked by link motion, and there is an adjustable cut-off valve working on the back of each main valve. The surface condenser has a condensing surface of 235 square feet. The air pump is vertical, single acting, the diameter being 6 inches and the stroke 6¼ inches. The screw is of brass, four-bladed, 55 inches diameter, and 8 feet uniform pitch, the combined area of the screw blades being 9.45 square feet, and their projected area on a plane at right angles to the axis 6.59 square feet. The boiler is of the Herreshoff type, with 557 feet of heating surface, measured on the outside of pipes, and 26 feet of grate surface. The steam pressure during the several trials was varied from 48.7 to 97.1 lbs. (gauge pressure).

The best economic result obtained was the use of 16.74 lbs. of water per indicated horse-power per hour, the steam pressure on the trial, when this result obtained, being 91.4 lbs., the revolutions per minute 190, the cut-off in high-pressure cylinder at .44 and in low-pressure cylinder at .208 of the stroke. In this trial 46.48 indicated horse-power was developed in the high-pressure cylinder, and 84.77 in the low-pressure cylinder. The speed was 12.37 statute miles per hour.

The highest average speed during any trial was 12.74 statute miles per hour, during which trial the steam pressure was 60.7 lbs., the cut-off at .88 and .29 of the stroke in the high and low-pressure cylinders, respectively; the revolutions per minute, 193; the indicated horse-power of the high-pressure cylinder, 27.93; and of the low-pressure cylinder, 113 horse-power. The water used per hour per indicated horse-power during this trial was 20 lbs.

The slip of the screw was practically constant during all the trials, viz., about 28 per cent.

The economy was the best when the cut-off valve on the low pressure cylinder was closed comparatively early in the stroke. A closure at points beyond one-quarter stroke showed, as the point of cutting off was increased, correspondingly increased loss in economic results.

Mr. Isherwood concludes that in compound engines with unjacketed cylinders, using saturated steam of high pressure, and with pistons working at high reciprocating speed, it is doubtful if any economic gain results from expanding more than four to five times. While this may be so, the tabulated results of the trials made by no means satisfactorily demonstrate it.

His conclusion that the idea of effecting economy by varying the point of cut-off in the low pressure cylinder is new, may be true so far as the Navy Department is concerned, but some of the oldest builders of compound stationary engines in the country have fully understood it for many years.

Mr. Isherwood, after dwelling at length upon the need of an almost infinite variety of experiments, in order to get a complete theory of the steam engine, concludes his remarks on that subject as follows:

"From the above may be inferred of how little value is the mere gabble uttered by many superficial writers pretending to give accurate numerical comparisons of the economy with which steam can be used in different types of engines, of the most economical point of cutting off, &c., and in the most general and absolute terms, not

only without specifying the limitations, but apparently ignorant that such limitations exist."

Technical and Mechanical Training.

We have received a copy of the inaugural address, delivered by President Charles Thompson, at the opening of the Rose Polytechnical Institute, Terre Haute, Ind. Mr. Thompson outlined the rise and development of technical schools, attaching immense importance to technicological culture, which he apprehended was already taking the place of the apprentice system of training. Division of labor and trades unions he asserted have conspired to keep apprentices out of shops, till now that plan of producing skilled workmen has disappeared, and the only resort for a boy who wishes to learn a trade is to enter a technical school. He associated many advantages for the technical course over the old apprentice term. A boy attending these schools, gets a good scientific training besides extended instruction in the trade manipulations and handling of tools; he acquires wide knowledge of machinery, and skillful handicraft that will enable him to earn a living while pushing his way to the higher positions. He recommends that all the scholars should be required to learn and practice shop work during their course.

We are far from undervaluing the advantages of scientific training for mechanics, but we believe there is too much inclination among advocates of technical schools, to depreciate practical skill and practical training in their ambition to magnify scientific knowledge. Scientific methods are daily increasing their hold on every department of machine work, and there is urgent demand for the services of workmen possessing that kind of knowledge. But without sound, practical training, the scientific knowledge is not available.

M. C. Bullock Manufacturing Company's New Shops.

In March last we published a plan of large machine shops that were in course of erection by the M. C. Bullock Manufacturing Co., at the corner of Lake street and Tallman avenue, Chicago, Ill. The works are now in operation, and were recently visited by a representative of the AMERICAN MACHINIST.

A prominent source of inconvenience and expense in machine shops located in large cities is, that ground is so precious it is difficult to find room for extending their facilities as business increases, so that work can be carried along by natural transition in its course toward finish. The Bullock Manufacturing Company have secured an excellent vantage-ground in this respect. While retaining all the advantages of a city location, with excellent shipping facilities, they have secured an open plot that will be available for future extensions—enough to make a mammoth machine establishment.

The work that the new shop is principally engaged on is the company's well-known mining machinery, which is in growing demand all over the world, and the Sweet Straight Line engine. Every department of the work is arranged on the most systematic methods for accuracy and dispatch.

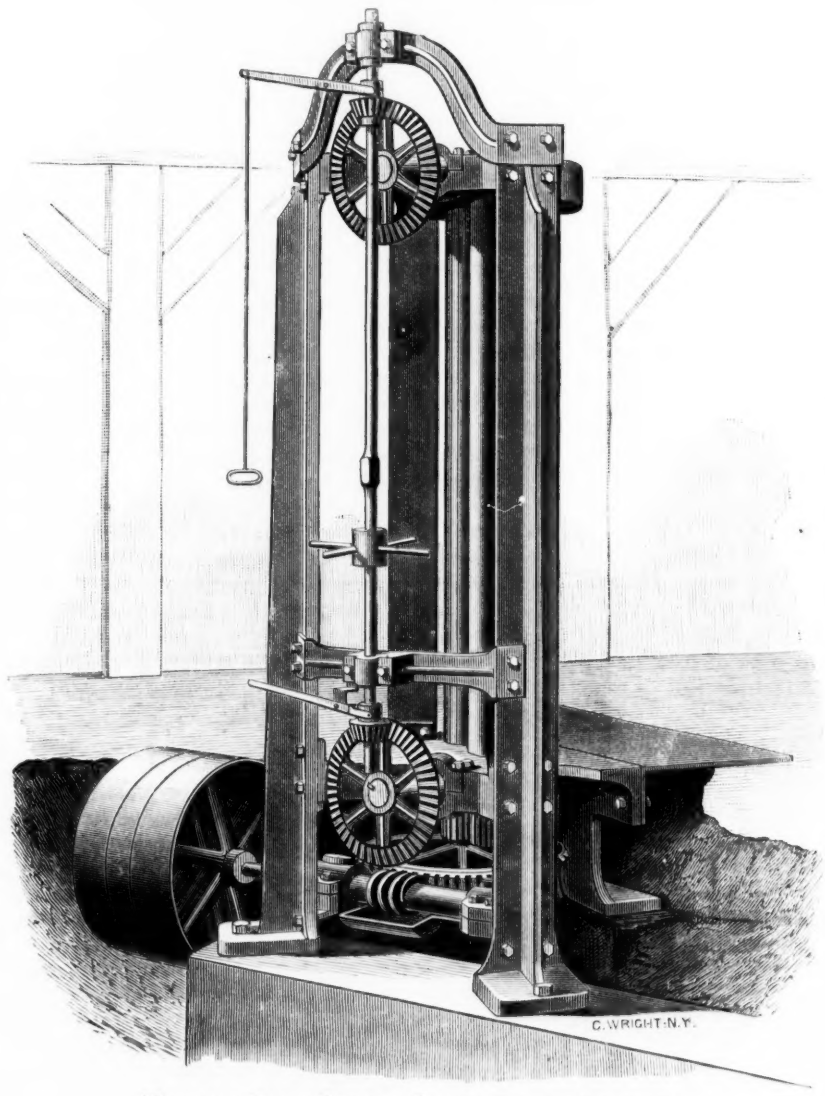
The drawing room, from which work may be said to originate, is a spacious room excellently lighted. Drawings are copied on blue prints 11"x21", which are pasted on boards of uniform size that are used as working drawings, and are found convenient to handle. All the drawings are kept in a series of drawers, and are arranged and labelled so that any particular drawing can be distinguished without searching.

Time and labor-saving appliances have been freely introduced into the pattern shop. It is equipped with a J. A. Fay & Co.'s Daniels planer, a double revolving saw, band saw, wood lathe, jig saw and circular saw, all made of the latest patterns.

The tool room of this shop is a model establishment. Here there is a Brown & Sharpe Universal Grinder, which is used for grinding tools, cutters, piston rods, valve stems and connections of Straight Line engine. There is also a tool lathe and Brainard milling machine for keeping up the work on tools The work is maintained at the standard size by the use of drop forged caliper gauges, made by the Betts Machine Company, of Wilmington, Del. They also use for tests Professor Sweet's micrometer gauge. An excellent set of surface gauges, made at the Madison University, is kept in the tool room. Every tool taken out has its whereabouts recorded by a perfect system of workmen's checks.

The heavy work of the shop is done on the first floor, where the largest tools are placed, and space kept for the erection of the massive machinery turned out. All through the shop good facilities for handling machinery and material by power are provided. Elevators for transferring goods to the different floors, stationary and traveling cranes for moving material promptly, save time and labor. On the second story floor there are three rows of small lathes at each side of the middle aisle, and ample space is provided between the lathes and the walls for erecting the machines turned out from the tools. Neat work-benches, which are conspicuously free from the usual assortment of "handy" rubbish, run round the walls, and a vise is placed at intervals of eight feet.

All the rooms are warmed by steam pipes arranged under the benches. Lavatories, with every convenience for cleanliness, are provided for the workmen. Any one wishing to see a well-arranged shop cannot do better than pay a visit to this establishment.



VERTICAL PLATE-BENDING ROLLS, FIG. 1.—See page 2.

French Electricians.

The fourth meeting of electricians of the society founded by the Comte d'Aros, was held in Paris last month. It was decided by the meeting that a committee should be appointed to frame the articles of a new society for encouraging progress in electric science and corresponding with those in all countries who have made electric questions the chief object of their studies and efforts. The evening's banquet was presided over by M. Loewy, member of the Institute, who had on either side of him M. de Lesseps, M. Faye, M. Robin, Admiral de la Gravière, M. Louis Figuier, and some thirty or forty others, including twelve members of the Institute, senators, deputies, journalists, and men bearing names well known in different branches of science. At the close of the dinner, between the toasts, M. de Lesseps announced a piece of news of importance. The president of the Suez Canal Company appealed to the members present to compete for a prize for the best means of lighting the canal by electricity. Without entering into details, it is evident, says the *Times*, that such an innovation would very largely increase the capacity of the canal for traffic.

Death of an Eminent Machinist.

Mr. John McFarland, Superintendent of Motive Power of the Chesapeake & Ohio Railroad died at Richmond, Va., on the 16th July, aged 57 years. Mr. McFarland was a self-made man in the best sense of the expression, having by his own native merit alone risen successively from the grade of working machinist to the highest mechanical position on an important railroad. He was a Scotchman by birth and parentage, but all the working years of his life were spent in the South. He was thoroughly conversant with every operating department of the railroad service, having had long experience as a locomotive engineer and machine-shop foreman. In 1855, Mr. McFarland was promoted to the position of master mechanic of the Richmond & Danville Railroad, then a small, insignificant road, but here he made his mark as a remarkably capable mechanic, and his vigorous management of his department during the war gave him prominence among Southern railroad men. In 1875 he was appointed to the Chesapeake & Ohio, where he remained till his death, admired as an energetic, competent officer, and respected as a worthy, kind-hearted man.

There are four new patents out for snow plows, which seem to rival each other as ludicrously impracticable appliances. One patentee undertakes to melt the snow that causes so much obstruction to travel by dumping it into a tank heated by steam pipes. Inventor No. 2 proposes to clear the track by means of a cannon which will keep up a continued discharge of blank cartridges into the snow-banks. Nos. 3 and 4 hit on the same idea, which is carried out by a slightly different method. Both of them are going to vanquish the snow-drifts by torpedoes pushed ahead of a snow plow. It would probably do no good to tell these inventors that their inventions are worthless, but we would strongly recommend each of them to attempt making a journey over a northwestern railroad during a severe snow-storm before they expend any money on their patents.

The Institute of Patent Agents.

Among other particulars relating to the first year's work of the body mentioned above, we take the following paragraph from *Engineering*. The organization of the institute was noticed by us at the time, with the suggestion that an inviting field for something of the kind was to be found in this country. Seven meetings have been held, at which a number of papers were read, and many matters relative to the patent laws considered. Our English contemporary says:

"It has been truly said that the class of patent agents is by no means a well defined one; they are essentially legal practitioners, and analogous to attorneys and solicitors, but without legal qualification or incorporation, so that there is no power to exclude a man without character or capacity for taking up the business, or to strike off the rolls in case of flagrant misconduct. The profession is one that calls for the exercise of qualifications of no mean order. Besides being familiar with patent law and cases decided thereunder, the patent agent should have a good general acquaintance with the various branches of manufactures, an analytical mind, an exact knowledge of language, facility and correctness of expression, and ability to read drawings.

"But whilst many patent agents are persons of skill and probity, yet, inasmuch as every person who can obtain employment is at liberty to act as a patent agent, the consequence has been that grossly incompetent and fraudulent persons have acted as patent agents, to the great loss and injury of unwary inventors induced to employ them. Under these circumstances, it would be difficult to over-estimate the importance and advantage to the public generally of such an association as the Institute of Patent Agents, which, as is well known, numbers amongst its members all the leading practitioners, and is intended to elevate the status of the profession and correct abuses. The first annual general meeting of this influential body was held on Wednesday last, and we are glad to learn from the report then presented by the Council that they were able to congratulate the members on the progress made since the incorporation of the institute in August last. The co-operation of a large number of patent agents in the provinces and abroad has been secured; and the advantages, both to the profession and to the public at large, of such an institute have already been proved.

"The original subscribers to the articles of association numbered 48; but as the objects and working of the institute became more widely known, numerous applications for admission were received and dealt with; and the total number of members is now 74, consisting of 52 fellows, 21 foreign members, and 1 associate."

A western engineering weekly, had a long editorial article recently on the mechanical differences of locomotive construction, which seemed to be written for the special purpose of showing how little mechanical knowledge there is on the weekly in question. The writer of that article, who evidently started out to diffuse advanced mechanical information to the readers, advances the existence of a theory that for making speed the stroke of a locomotive should be considerably greater than the diameter of the cylinders, but to give hauling capacity the two measurements should nearly approximate. There may be theories that indicate such a style of locomotive construction to be practicable, but it is well known that all railroad men and locomotive builders hold views diametrically opposite. The assertion is also made that practice does not substantiate the theory, or any other theory, regarding proportions. Now, every person who understands locomotive construction in a respectable degree knows the existence of a distinctly recognized practice of giving fast engines a short stroke, and slow, heavy-pulling engines a long stroke, and this principle was conspicuous through the whole locomotive exhibit at Chicago. If the opposite theory has ever been advanced, it is a decided case of theory being opposed to practice; but the case is probably only the misconception of ignorance.

The Steamship Hudson.

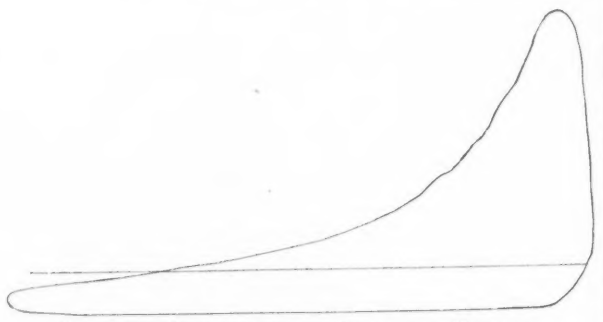
The steamship Hudson, built in 1874 by Messrs. Pusey Jones & Co., of Wilmington, Del , for the Cromwell line, trading between New York and New Orleans, has an engine with a notable history. At the time this vessel was designed the compound system had worked into popularity, but John Baird, chief engineer of the Cromwell line, did not share the prevailing admiration for compounding, considering the engines were too expensive in repairs. He planned the Hudson's engine in a style that he regarded would make repairs light, while the steam would be expanded down so low in the initial cylinder that a low pressure cylinder would be unnecessary.

A close inspection of the engine, which has now run nine years, making 1,200 miles a week regularly, having made 148 trips from New York to Orleans and back, leads us to the belief that the engine has been an undoubted success. In that period there has only been a stoppage of thirty days for repairs, which were then comparatively light. When we visited the engine room, the main rod was disconnected for examination of the crank pin, and it was as fine looking a connection as we ever saw. The original main rod brasses are still in use, and they look good for nine more years of constant service.

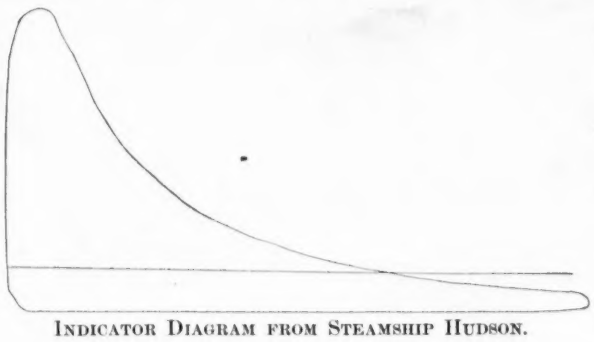
The engine has a single inverted cylinder which was originally 48″ diameter, but has been bored out to 48½″, and the stroke is 72″. The weight of the crank and reciprocating parts is counterbalanced by a heavy back crank. The striking peculiarity about this engine for marine service is the valve motion, which is of the Corliss type, with most of the leading features of that gear. Steam is distributed by four double beat poppet valves worked by wipers on rocking shafts and cams on crank shaft. Dash pots are used and the cut-off takes place almost instantaneously after the opening mechanism is unhooked. The length of the cut-off is regulated by a lever worked in a quadrant at the hand of the attendant engineer. In practice, the steam ports are kept open to allow the steam to follow the piston during the greater part of the stroke while leaving and entering harbors; but so soon as the vessel reaches an open channel the steam is cut off very short, and expanded down to 7 or 8 pounds absolute before the opening of the exhaust.

The accompanying cards taken during the ordinary course of working during the last trip, give a very good account of the steam and indicate that no compounding is needed with this engine. The boiler pressure was 65 pounds, the engine running 59 revolutions and vacuum 22″.

When the engine of the Hudson was in course of construction the plan was subjected to much criticism by certain leading engineers, very decided opinions being expressed that the tremendous blow which the piston received at the beginning of each stroke would pound the engine to pieces in a short time. This opinion was held by many of our ablest marine engineers. But it proved erroneous. No engine that trades into this port works smoother, and the low average expense for repairs has seldom if ever been equaled. Although the valve and reversing gear look complicated they work quite easy and noiselessly, and have given no trouble from breakage or wear. The reversing gear is the old drop hook, and it is found easily handled and convenient in practice. One man has no difficulty in reversing the engine at any time.



INDICATOR DIAGRAM FROM STEAMSHIP HUDSON.



INDICATOR DIAGRAM FROM STEAMSHIP HUDSON.

LETTERS FROM PRACTICAL MEN.

Fine and Coarse Feed.

Editor American Machinist:

In a recent issue of the AMERICAN MACHINIST, John Ironsides attacks the "Yankee" fine-feed system without going into the reason of its adoption. I should judge from the tone of his letter, that he has never used one of these terrible "Yankee" lathes, but then a good many writers for the technical press are gifted with a wonderful amount of instantaneous inspiration in such matters.

Such lathes as Mr. Ironsides describes were never designed to turn crank shafts for ocean steamships and similar work, but they fill the bill for the purposes for which they were designed, viz., general light machine work. He does not find lathes of 20″ swing and upwards constructed in the way he outlines. Such lathes are better with gibbed carriages, but can at the same time be provided with elevating tool-posts. This requires a large bearing on the carriage, and as a result is not so handy for tool work as the weighted, narrow carriage. This carriage, for tool-makers' use, will never be beaten.

As to feed, there are but few lathes with belt feed that do not feed outrageously coarse. This is a matter that manufacturers do not pay proper attention to. The plan of feeding with a belt has this one advantage: the grade of feed can be more quickly changed than where gears are used. But by using gearing a greater variety of feeds can be obtained, and the feed is more positive. Where belt feed is used, it is sometimes found impossible to turn a hard piece of steel, the finest feed being too coarse.

As a conscientious mechanic, I believe in a slow speed and coarse feed when the work will admit of it, but when a fine feed is required I believe in having it, even if it does require "traps" to bring it about.

I think I am reasonably well acquainted with New England tools, and as a draughtsman have often found it was not always plain sailing to bring out everything that might be desired in a single machine, but this fact is generally overlooked by those who criticise machine tools.

In planer feeds, I have changed no less than seven of New England make, so that steel dies, as well as other work, could be planed upon them. The round-pointed tool plan will not always work. It will answer in its place, but its place is not everywhere.

C. E. SIMONDS, Tool-maker.
Yale & Towne Manufacturing Company,
Stamford, Ct.

"We" versus "I" in the Shop.

Editor American Machinist:

In your issue of July 21, F. J. Masten conceives some very pretty pictures of peace, harmony, and good-will in the machine shop. It may be pleasant, as an amusement, to look on the bright side of things, or to let the imagination picture them as having bright sides, but the principles of Friend John Bright are a good way from governing in the ordinary machine shop of to-day. This unity of feeling—co-operation of proprietor and workmen—is one of the things that will go to make up the millennium, perhaps, but need not be looked for before the arrival of that event.

Pride of opinion has been and always will be an obstacle to the co-operation so much to be desired. Everyone seeks to unravel the mysteries before his neighbor, and as he thinks he succeeds, his pride correspondingly increases.

I once hired as foreman to a man whom I will call Brown. Brown was a thorough mechanic himself, and was not beholden to anyone for skill to do anything. I know this was true, because he told me so himself before I began work. I had an order book, with authority to take orders from customers. During the afternoon of my first (and last) day, a broken pulley was brought in from a neighboring sash factory. I entered the order, and went to the office and inquired if the parties were all right. The bookkeeper said, "O, yes, they are all right; we do their work right along." Finding a pulley casting in stock, I had the job well under way when Mr. Brown came along and asked what job that was. I told him. He said that was wrong; they would never pay for it. I told him what the bookkeeper had told me. Then he said the man doing the pulley was not capable of running that lathe. I told him that I found the man in charge of the lathe. Said he, "That lathe is not suitable to do that job in." I showed him that the pulley would just nicely swing over the rest. With great indignation he exclaimed, "Take that pulley out of the lathe, and tell Johnson & Co. that we have not the facilities for doing that job!" I put on my coat, and told him that if in my travels I should see anything of Johnson & Co., I would surely tell them. This man had a pretty good shop of his own, and was doing as well, financially, as the average: but I failed to see much "peace, harmony, and good-will" there.

Q. K.
Cincinnati, O.

The Treatment of Steel Tools.

Editor American Machinist:

Replying to Mr. Gartside (in your issue of July 28) I can only say that I see nothing to "get mad" at and no reason to "strike back," but still 'tis human to take the chances for the last word, and as it might seem discourteous not to reply to the "friendly criticism" of a man who "was raised among steel," I will begin by saying that as I had no personal acquaintance with Solomon, I do not consider myself competent to judge whether his decisions, with all of his wisdom, may not, some of them, have been unwise. Whether a boy has spent two years or twenty years, or two months or two hours in learning some of the simplest facts in relation to steel working is of little importance. The main question is: Is he in possession of the facts?

No, a man who was foreman of a machine shop and did his duty in that position could hardly be a blacksmith at the same time, but he might be capable of forging and tempering or redressing any tool in common use in a machine shop, or of giving the ordinary tool dresser instruction.

If Mr. Gartside means to be understood that all steel can be made soft enough to be readily cut with ordinary tools, he must have been exceptionally fortunate in his experience. If he means that all steel may be heated and allowed to cool slowly, which is the process of annealing, that is another thing.

And now, Mr. Gartside, we come to the real pith of the subject. I say, "A good big fire, not too hot, not too much blast, but just enough," and you incline to laugh at me. You ask: "What weight of coal? What temperature? How to heat evenly?" I reply, a sufficient body of coal ignited to provide a good depth of fuel between the heating steel and the tuyere, and to avoid the necessity of too much blast to secure the requisite heat. Heat evenly by turning in the fire and giving time for the piece to be heated through, and as nearly the same heat as possible for the entire length of that part which will be subjected to the forging process. I say, "Let the blows be so delivered as to cause no more violent distortion of the metal than is necessary," and you say, "in other words, strike lightly." I say no such thing. I say strike light or heavy blows just as the size of steel or character of tool requires, always intelligently gauging the blows to the size of the work, and I stick to my original statement with great tenacity. Too violent distortion of steel is injurious.

And now I come to "Joe, the tool-dresser," who has just said that in his opinion my instructions for dressing tools are wrong. He says: "Any fire." . . . "As hot as can be without burning the carbon." . . . "Let the temper down to a straw color." . . . "Know no valid reason why I should not heat as high as the man who made the steel." . . . "Draw to a straw color, because experience has taught that with a higher temper than this the edge will crumble."

Why, Joe! you have "given yourself away." Whenever a tool needs drawing to a straw color to prevent the edge from crumbling, there has been something wrong with heating, forging or hardening. Letting the temper run down leaves the extreme point of tool harder than any other part, and if the point is *just right*, how can any part above be *right?* Conundrum. The use of smooth hammers and anvils is to be commended, but "any fire"—heat at which steel manufacturers weld up ingots, or draw billets into bars! One heat for forging and tempering a lathe or planer tool! Why, these are some of the very abuses that I was in hopes to have a hand in reforming, and here comes a practical man who knows all about it, and who says these are the proper methods. It may be unseemly to contradict, but "any fire" won't do. It must be a good, clean fire, and tempered according to the size and character of the work. No piece of steel can be *properly heated* in too hot a fire for annealing, forging or hardening. When the steel manufacturer has heated the ingot to a welding heat, and drawn it to a billet, and reheated the billet to a yellow heat bordering closely upon white to draw it into bars, enough of that treatment has been had. These are stages in the process of steel manufacture, as are smelting and teeming; and once done properly, do not need to be repeated.

Now to Mr. Gartside, "Foreman," and to "Joe, tool dresser," let me say that "Jim," another tool dresser whom I know, has learned within the past few months from a man who *works* at machine work sometimes, and *can* dress his own tools, how to make lathe and planer tools which call forth such remarks from the men who use them, and from the foreman in the shop where they are used, as, "Beat any tools I ever saw," "Can turn or plane unannealed or hard steel, dirty wrought iron, or hard cast iron with them, which cannot be worked with any other tools in the shop, and for all ordinary work one of these tools will outlast a dozen such as we have had before." And "Jim" says that it takes but very little longer to make this kind of tool, while their greater durability makes really less work for him ("Jim" works by the day for the concern who use the tools), as, if the tool is right to start with, the degree of hardness being practically the same for quite a distance back from the point, it can be ground and re-ground many times. It may be humiliating to "Jim" that he learned this from a machinist instead of from "the king of mechanics," a blacksmith; still he seems pleased that he has learned. Let me repeat what I have been laughed at for stating, but can't be laughed out of: A piece of steel properly worked and properly hardened, with temper undrawn, is in its best possible condition for all ordinary lathe and planer tools, and if the edge "crumbles," it is proof that something has been done wrong if the steel in the bar was right. I was not

exactly "raised amongst steel," but have been working and using it, sometimes in one way and sometimes in another, since long before Pittsburgh steel found its way into the market. That as good steel is made in Pittsburgh as in any other place in the world, I fully believe. That tons of the best steel are practically ruined daily by being heated too hot for forging, annealing, and hardening, and that dirty fires, and scant supplies of fuel with high blast, and too great distortion by ponderous blows not suited to the size of steel under treatment, are the rule in many shops, I as fully believe. Of course, if I had been a blacksmith, "king of mechanics," I might have entered my remonstrance in such language as to have escaped the "friendly criticism," or excoriation, of Mr. Gartside, which has fallen upon me like water on a duck's back. "Get mad, indeed!"

S. W. GOODYEAR.

Screw Wire Gauges for Screw Plates.

Editor American Machinist:

If C. B., who asks a question in your issue of July 28 about screw plate and wire gauge, will use the screw wire gauge he will have what he wants. Numbers 2, 3, 4, 5, 6, 8 and 9 on the screw wire gauge correspond to numbers 14, 13, 12, 11, 10, 8 and 7, respectively, on the English gauge.

P. Mathes, Supt. Nimick & Brittan M'f'g Co., Pittsburgh, Pa.

The Template System in Repair Shops.

Many machinists and some parties in charge of machine shops are disposed to think that the prevailing tendency toward uniformity in machine work is being pushed to extremes. Others, of the conservative kind, hate to part with old methods and hang with persistency to the foot rule and calipers, in preference to the exact template and invariable solid gauge.

In discussing this subject there are extremists on both sides. One party can see no excuse for men continuing to produce machine work of any sort that is not interchangeable. The other side sees in the growing system of iron bound sizes the end of individuality of design and the stifling of inventive enterprise. By the development of this system they perceive a condition of things not very remote, when the machine world will be a great unthinking automaton. Every article from a pin to a steamship will be turned out by established templates producing a world of sameness without variety or beauty.

We certainly do not apprehend the approach of this petrifying process, for the growth of intelligence will prevent the stifling of individuality among an enlightened people. But there are practical limits to the system of uniform sizes. When the leading machinists in the country agreed to make all $\frac{3}{4}''$ bolts with 10 threads to the inch and of a certain form, they introduced uniformity into a department of work which all were interested in, and where no great amount of inconvenience was to accompany the benefits arising from the change.

In adopting a uniform system of screw threads there was no opportunity for radical diversity of opinion respecting sizes. Every machine builder who desired to do so could work into the standard sizes without serious shock to his prejudices or disturbance to his business. But when an attempt is made to carry the principle of general uniformity further, and tell makers of rival sewing machines or of rival engine lathes that there is no good reason why they should not agree to standard patterns so that their machines could be made interchangeable, pride, individual taste and conflicting interests intervene to prevent agreement.

Without attempting to push the practice of uniformity to the extreme limits that would rob our machinery of the attractions begotten of diversity in designs, there is a possibility that much convenience might result from extended use of the template system on work where it is now little known. It is not necessary that a whole complete set of templates should be got out before the principle can be successfully applied. A good start can often be made by ten or a dozen pieces.

Take the case of a railroad with locomotives from four or five different makers. It is a very unfortunate position for a railroad to be in, so far as the keeping down of expenses for repairs is concerned, but many railroads are so situated and they must make the best of it. Now, to consider each locomotive a standard of its own make, the parts to be maintained of the original dimensions, requires the piling up of an immense accumulation of patterns for carrying on the work of repairs, and endless confusion arises from diversity of patterns for the same size of article. In a case of this kind, some degree of uniformity can be reached by making one style of locomotive the standard, and gradually working the others into the same dimensions. Without radically changing the locomotive, many parts can be reduced to a standard. One of the commonest cases of breakage is a spring. The equalizers and saddles can be changed, so that springs belonging to all the engines of a certain size shall be interchangeable. This is a big start in the way of reducing the stock that must be carried. Then all pump and injector attachments may be brought to the standard and boiler head fittings made interchangeable. Oil boxes, cylinder heads and front end castings may be made uniform, and kept in stock ready to put on when needed.

A system of this kind can be worked up without inconvenience to the business, and every extension towards uniformity will be apparent in the promptitude with which repairs can be carried out. The further the plan is carried of every fitting being finished to exact template, in a like proportion will the expense of repairs be reduced and the means of keeping the engines at work will be increased. Take a railroad which is short of power, and nearly all roads are in that condition at certain seasons of the year. An engine comes in with the front end knocked in, a steam pipe broken, a cylinder head fractured, and the pilot demolished. Where the template system is in vogue, that engine can go out with a train in four or five hours after reaching the round house, for all that has to be done is to tear down the broken pieces and put up the new parts which are at hand finished. With the fit and try system, the castings have to be brought from the casting house, put up to their places and laid out for drilling, dragged to and from the drill press, the head has to be ground, the rings of the steam pipe have to be turned and fitted, all of which operations consume valuable time. By this means the services of the engine are lost for two days, and the loss in a busy time represents more money than would pay for the construction of a good many templates.

A limited use of the template system could be advantageously introduced into other departments of machine work. Where ordinary judgment is used in working to uniform sizes, the practice is satisfactory and economical.

The formation of a company whose specialty is furnishing capital to persons going into business, is an interesting financial item for the dog-days. Exactly what steps the new company proposes to take to determine the ability and reliability of the men in whose hands it proposes to intrust capital sufficient to float the business they wish to establish, it is not easy to say. Men who invest money in business ventures usually want to know something more of the individual qualities and history of the persons with whom the arrangement is made, than it would seem such a company would be able to learn readily at wholesale.

When it is proposed to enter upon the manufacture of mechanical specialties, a considerable range of mechanical and business wisdom, on the part of the new company, will be demanded. If anybody doubts this statement, we fancy an inspection of even a single issue of the *Patent Office Gazette* will supply arguments enough to fully substantiate our opinion. Altogether, the field in which the new organization proposes to work is both wide and dangerous, and very careful management will be required to enable it, or a respectable proportion of its beneficiary enterprises, to make a successful start. If the new company should, instead, devote its capital and energies to supplying fairly-established machine shops, mills, and factories with machinery, payable in yearly installments during ten years, on the plan adopted by the Car Trust organizations, now so largely looked to by new railroads for equipment facilities, its enterprise would, perhaps, promise equally satisfactory results. But, doubtless, a plentiful issue of equipment mortgage bonds would be found a business necessity.

Men who have paid close attention to inventions are aware that precisely the same kind of mechanical device is frequently produced by different inventors about the same time. Old devices that have become obsolete and forgotten are constantly turning up as new inventions. The intelligence that an important modern invention was forestalled hundreds of years ago comes from Turkey. The *Official Gazette*, of Aleppo, says that a party of engineers, while making excavations below the citadel, found a wrought-iron, breech-loading cannon, which must have been buried for 250 years. The breech mechanism is reported to be almost identical with that used by Krupp on the German cannon.

Mysteries About Steam Engines.

Twenty years ago there used to be a great deal of talk among engineers and machinists about mysterious differences in the working of engines that were built exactly alike. In stationary and marine engine practice it was often said that no two engines were alike in point of economy, and with locomotives one engine would be smart and another one lazy, one would steam freely, while another could hardly make steam enough to get over the road. All this was popularly supposed to be the case while the parts of the engines were precisely the same dimensions. The free introduction of the steam engine indicator exploded these fallacies, and taught engineers and machinists an applied lesson on the principle that there is no effect without a cause. A few men still hang to the old prejudice that the performance of two engines differs from no particular cause, but such views are getting scarce.

In the days when the mystery theories held full sway, the engine of a river boat began to work very unsatisfactorily. The engineer could not make out what was the matter, and he went and consulted the best mechanical talent in the neighborhood. Defective piston rings were blamed as the cause of trouble, and new rings were put in, but the engine was no better. Another doctor was consulted, who laid the defect to the valve, and recommended a new valve and facing of the seat. This was done, but still no improvement. The engine was now working so badly that the work of the boat was seriously impeded. At this time a young engineer, who believed in the close connection between cause and effect, happened on the boat. He listened to the engine working, and at once expressed the opinion that the exhaust was choked in some way. The engineer of the boat insisted that the exhaust was perfectly free, but the other held to his opinion, which was based on the sound of the exhaust steam. It led to an examination, and the pipe of a heater through which the steam passed was found collapsed, almost closing the steam passage. When this was put right, there was no more trouble with the engine.

According to the *Water-Gas Journal*, the capital stock of the various electric light companies in this country now aggregates an amount greater than that of the National debt.

Torsional Tests of Steel, Made by the Pratt & Whitney Co.

The Pratt & Whitney Co., Hartford, Conn., have recently made some torsional tests of round tool steel, the results of which are given in the annexed table. These results are not only interesting and valuable as showing the strength of the different brands of steel tested, but as showing the effect of annealing and hardening on the strength of steel. Altogether, they are a valuable acquisition to the somewhat meager knowledge on this important subject, and the Pratt & Whitney Co. are to be commended for their efforts in this direction. The pieces tested were 4" total length. From each end the pieces were square for a distance of $\frac{13}{16}''$, one end being $\frac{5}{8}''$ and the other $\frac{21}{32}''$ square. The central parts of the pieces were round, the diameter being 0.6184 inch, equal to an area of $\frac{3}{10}''$ square inch. As will be seen, 18 tests in all were made of each brand of steel—six unannealed, six annealed, and six hardened. The figures given represent in pounds the strain, applied at a radius of 6", required to twist the specimens off. In all other respects the table is self-explanatory.

TABLE OF TORSIONAL TESTS OF STEEL.

	No. of Test.	BRANDS OF STEEL. B. Atha & Co. A	Spaulding, Jennings & Co. B	Jonas & Colver. W	Thos. Firth & Sons. F	Wm. Jessop & Sons. J
Unannealed. Direct from bar.	1	853	864¼	894½	790	954¼
	2	855¼	768	887¾	863	916½
	3	840	861	896	809½	931½
	4	849½	872½	900	856½	896
	5	853½	884¼	896½	857½	916¼
	6	849½	873	877	....	900
	Total	5,101½	5,124	5,351¼	4,176½	5,515
	Average	850 5/24	854	891 23/24	835 3/10	919⅙
Annealed. 24 hours.	1	769	645	833½	759¼	891½
	2	774	770	813	758½	869½
	3	790	770	789½	765¾	805
	4	773	762	784	764½	859
	5	792	581½	773	767½	894½
	6	768	600	771	759¼	849
	Total	4,666	4,128½	4,763½	4,575½	5,168½
	Average	777⅔	688 1/12	793 11/12	762 7/12	861 5/12
Hardened. Medium straw color.	1	1,349½	1,440	1,180	1,352	1,330
	2	1,400	1,166½	1,456	1,430	1,309
	3	1,402	1,560	1,349	1,402	1,215
	4	1,434	1,606	1,630	1,427	1,247
	5	1,550	1,302	1,500	1,480	1,254
	6	1,101	849	1,702	1,329	1,243
	Total	8,236½	7,923½	8,817	8,420	7,598
	Average	1,372¾	1,320 7/12	1,469½	1,403⅓	1,266⅓

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NEW YORK, AUGUST 11, 1883.

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A boiler exploded at the Glen Falls, Mass., paper mills a week ago, killing several persons and injuring many more. The owners are searching for some abstract cause for the explosion, so that the question of natural weakness of material may not come into consideration.

We are pained to learn, on the authority of the *Weekly Courier*, of Norwich, Ct., that Charles A. Burnham, of that city, died on July 4th last, at the age of forty-two years. The deceased was a business man of fine attainments and high standing. He was the son of Charles Burnham of Philadelphia and nephew of George Burnham, of the Baldwin Locomotive Works.

William Crossett, one of the oldest settlers of New Jersey, died lately at Paterson. Mr. Crossett was for many years employed in the first factory that carried on the systematic manufacture of the Colt revolver. He worked on the handles, and was an unusually skillful mechanic, having made the stock for a gun that won the gold medal at the first American Institute fair at New York.

Monterey, an ancient town of California, with considerable antiquarian and scenic attractions, has shown commendable enterprise in bringing a water supply from the Carmel river, twenty-five miles distant. Engineering difficulties of some magnitude had to be overcome in laying the convey pipes through a wild rock-fissured region. It is expected that the supply of excellent water secured will give Monterey a boom as a summer resort.

A terrible accident happened last week, at the Onondaga Iron Company's blast furnace, near Syracuse, N. Y. The furnace had been cooled down for repairs, and while a gang of men were engaged building a new lining, the upper portion of the wall fell without warning, and killed eight of the men on the spot. There must have certainly been great carelessness pursued in working a gang of men in such a dangerous position, without means being provided to prevent the falling of an overhanging wall.

Quite a number of attempts have been made to extend the smoke-stacks of locomotives over the tops of the cars by means of pipes, making the point of emission the back end of the train. Could this be carried out, it would effectually cure the nuisances of smoke and cinders. But the thing has been found impracticable, for the numerous joints could not be kept together with a train jostling round curves at high speed. An inventor, all the way from Constantinople, Turkey, has now taken out a patent for a device of this kind. Perhaps if he had known a little more about American railroad matters he would not have invested his money in a patent of this kind.

A series of experiments are now being made with Ericsson's torpedo boat, the Destroyer, which was illustrated and described in the AMERICAN MACHINIST of September 24, 1881. Various tests have been made to prove the speed of the vessel, and her convenience in handling, all of which came out satisfactorily. The craft is said to behave well in a sea-way, and although seventy feet long she turned sharply around within her own length. Torpedoes were fired from the submerged gun which is ten feet under water in the bow of the boat. The desired range was attained and the firing was accurate. Further experiments are to be made under various conditions.

Notwithstanding the existing depression in the iron and other industries, the outlook for fall business in the machine line continues to improve, and the prospect for the year is distinctly brighter. The promising condition of the crops, some of the most important being now practically beyond risk of failure, together with export prospects, promise satisfactory results for transportation interests. The prosperity of the railroads is so important a factor in general business, and especially the machine business, that hopeful views are not out of order. Whatever measure of disturbance to business during the past three months has arisen from the inauguration of the new tariff on July 1st is, or should be, also now practically over, and increased steadiness should follow.

Three large steel steamers are in course of construction on the Clyde for the Canadian Pacific Railway. They are intended for service on the northern part of Lake Superior to make connection between two railroad points. The boats possess some interesting mechanical features. The engines are 1,700 horse-power, and they will be supplied with steam by two steel boilers, each 14 feet diameter by 12 feet 3 inches long, which will carry a pressure of 125 pounds. The vessels are 270 feet long, so they cannot pass through the canals into the lakes. For the purpose of transportation, however, they have been designed in such a manner that they can be cut in two parts at Montreal, and floated into Lake Ontario in this condition.

The new steamer Oregon, launched a short time ago at Glasgow, Scotland, for the Guion steamship line, will have the largest engines in the world. The ship is exceeded in tonnage by several vessels that are in service, but nothing like the same proportion of propelling power has been provided on the predecessors of the Oregon. Her engines are of the compound type, with three inverted cylinders standing above the main shaft, to which the connections are made direct. The high-pressure cylinder, 70 inches diameter, is in the middle, and it exhausts into two low-pressure cylinders, each of them having a diameter of 104 inches, the stroke of all the cylinders being 72 inches. The engines will indicate 12,000 horse-power, and it is expected that the vessel will be faster than anything afloat.

One of the most stupendous enterprises of modern engineering is likely to be stifled in its incipiency. The work of connecting England and the Continent of Europe by means of a submarine tunnel has been condemned by the military authorities of Britain. These military men have always been noted for holding retrogressive views on public policy; so it was understood when they were called upon by a Parliamentary committee to express their opinions of the Channel Tunnel, that their whole influence would be exerted to defeat the scheme. They talked as if the French would have no difficulty in walking through the tunnel, and taking possession of the Bank of England, the Tower, and every institution dear to Englishmen. To prevent the aggression of the savage Gauls the nation's defenders thought that a fortress costing ten millions of dollars, and maintained at an annual expenditure of two and a-half million dollars, would be needed. As military opinions are much deferred to in the British Parliament, the construction of the tunnel is likely to be stopped.

In a late railway collision in Scotland, where five persons were killed, the government inspector's report proves a curiously-confused condition of train brakes. The train consisted of two engines and fourteen coaches. The leading engine was fitted with an ordinary hand brake; the train engine was fitted with a Westinghouse brake, which worked only on the drivers and tank, the coaches belonging to a connecting road that did not use the Westinghouse system. The front baggage car and the two following coaches were connected with a patent chain-brake. The middle part of the train had the brakes connected with a car where no one was stationed to work them, and the hind part of the train had brakes connected with the last vehicle, and could only be worked by a brakeman at that point. This train was rushing along at fifty miles an hour when an obstruction was suddenly presented 360 yards ahead. An accident was inevitable, with such bungling methods of stopping. American trains of equal weight, and running at like speed, stop in half the distance every day. And yet John Bull sneers at our reckless system of railroading.

Trades and Callings.

It is interesting to observe the depth of meaning, that may attach to common expressions, which ordinarily are passed over without attracting special notice. We speak of such-and-such a man as "working at his trade;" of such-and-such another as "pursuing his calling." Now, why should not every man who works at a trade be, in the best sense, pursuing his calling? If a man is engaged in the work pertaining to a certain trade, because he stumbled into it by accident when a boy, and cares nothing about excelling in it, that man may, perhaps, truly be said to be working at the trade of machinist or blacksmith, or what not. The man, however, who was impelled to enter on mechanical work when a boy, less from the force of circumstances than because of a strong natural inclination, may be truly described as "called" to follow that particular pursuit.

Whoever does man's work is doing God's work, and any calling which is pursued for the love of it, to the accomplishment of results useful to mankind, is entitled to man's fullest respect.

Bribery in Business.

A fire-engine manufacturer of long experience said recently that he could count on his fingers the fire-engines which he had been able to sell in his business career without bribing somebody, in a greater or lesser degree. Not always persons occupying the same position with respect to the machine to be purchased, but always somebody. Now some member of the committee or town council had to have a gift or something of value, though the motive governing the transaction was seldom clearly stated. Another time it would be some clerk or other person holding business relations with the committee or council. Another time it would be some friend, wholly outside, whose influence with the purchasing parties was wanted. Sometimes fire department officials were not above reproach, while at other times the favor of engine-house occupants was a valuable point to be gained, not by convincing them of the mechanical value of the engine, but on grounds of personal favor, aided, when need be, by ways that were dark.

A prominent builder of hydraulic machinery not long since had a somewhat similar experience in filling an order for machinery given his concern by a certain railroad. After the machinery was put in place, and before the bill was paid, the road changed hands, and the new purchasing agent said the bill would be paid, less one thousand dollars. As the correctness of the bill was not in any manner disputed, this demand evidently meant personal tribute and nothing else. Afterwards the amount of the demand was lowered to five hundred dollars. Appeal to the president of the road (whom subsequent information showed to be a relative of the purchasing agent) producing no better result, suit was finally brought, and the bill was paid in full. Some time later, a member of an establishment handling another line of goods, asked our hydraulic friend why he quarreled with the purchasing agent of the railroad in question, concluding with the remark that he thought money was lost on future transactions by so doing, and suggesting that it was quite feasible in the case of roads doing business "on that plan" to get prices high enough at first to render quarrels of this sort unnecessary. The presumption was that the speaker's firm regarded the payment of tribute in such cases as a regular business incident.

Taking these two cases as illustrations, the questions which machinery men have to consider are: How numerous are such practices, and what is the proper method of treating them when they occur?

The Twenty-Fourth Annual Report of the Trustees of the Cooper Union.

The Trustees of the Cooper Union in their twenty-fourth annual report, furnish another interesting chapter in the history of one of the wisest and best conceived benefactions of the age. It is not necessary to study this report to get an idea of the good work so quietly carried on at the Cooper Union, for everywhere in the country, occupying places of prominence and usefulness are those only too willing to honor the name of Peter Cooper, and who point to the knowledge gained in the schools so unselfishly founded by him as the stepping-stone to their present positions. Nevertheless this report is of interest in many respects, and in none more than in leaving the impression that there are those left who will look to the interests of this model institution, after which others have copied, but which none have equaled.

From this report it is learned that the number of pupils who entered the different classes during the year was 3,917, of which number 1,167 entered the evening scientific classes. Of the total number entering, 2,074 remained in regular attendance throughout the year. When it is considered that the students are mostly those who must work during the day, many of whom from economical reasons, and others from necessity would seek work elsewhere, thus removing from the opportunities of the school—this with other natural causes that would diminish the attendance—the number that continued throughout the sessions must be most gratifying to those interested in the welfare of the school.

The reading-room has on file 370 newspapers and periodicals, and there are in the library 16,798 volumes, including many works of standard authority in the arts and sciences. The number of persons who visited the reading-room last year was 475,988, or an average of 1,442 daily. The number of books distributed was 170,155, being more than 500 daily. The library and reading-room was opened a half day each Sunday during the fall and winter months, and it is a noteworthy fact that on these Sundays the average attendance was 2,000—a materially greater number than on week days when open all day. Popular courses of lectures were given during the fall and winter, and the large lecture hall, seating about 2,000 people, was generally well filled.

The least pleasing part of the report is that without more room and more money the limits of the usefulness of the institution are reached, in many instances applicants being obliged to wait for a year or more before gaining admission. There is room enough in the building, but portions are leased, the rents from which form a considerable part of the support of the schools. An opportunity for some liberal man or men of means to use some of it to a most useful purpose is opened by the growing needs of the institution.

With one exception the classes are all free to everyone, and that exception in no way conflicts with the general character of the institution. That is what is called the "Amateur Class," which meets out of the regular class hours. The formation of this class was permitted on account of the pressure for admission to the regular classes; it is composed of those willing and amply able to pay. The pay exacted is sufficient to compensate the teachers for their extra services, and assist in a small degree to support the free schools.

The Cooper Union was instituted for the sole purpose of benefiting those whose duties do not permit the spending other than leisure time in obtaining such knowledge as is there imparted, and to a young man who is determined to study, there is just enough of difficulty in the way of doing it there, and in hours that would otherwise be devoted to amusement, to confirm a habit of surmounting obstacles that will be likely to characterize his future actions. It is a school in a double sense, and an institution that has been the means of making thousands better than they would otherwise have been.

While Peter Cooper has provided for the continuance of this school on its present basis, New York should honor the name of a citizen who has so honored the city, by seeing that its capacity for usefulness is increased.

It is pleasing to note, in relation to the future support of the institution, that in addition to the $100,000 bequeathed by Mr. Cooper, his family will contribute another $100,000, which they believe to have been his purpose, had he lived.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(263) B. D. H., Dunkirk, N. Y., asks: How heavy fly-wheel shall I require for an engine 2"x2½", to run at 350 revolutions per minute? *A.*—If 12" diameter, about 25 lbs.

(264) G. F., Syracuse, N. Y., asks: How shall I determine whether the crank-shaft and crank pin of an engine are in line, after the engine has been running some time, without the use of a line? *A.*—This subject is fully illustrated in the AMERICAN MACHINIST of August 28, 1880.

(265) M. N. O., Easton, Pa., asks: What are the advantages of elliptical over eccentric gearing? *A.*—The object of irregular gearing, as eccentric or elliptic, is to produce irregular motion. In some cases the motion desired can be got from one, and in other instances from the other kind. It is not a question of advantage, but of adaptability.

(266) C. P., Philadelphia, Pa, writes: We have a tank holding 350 gallons. It is half filled with water, 12 lbs. of soda added, and then it is filled with cotton yarn and boiled for five hours. What I wish to know is, if the liquor would be suitable to use in a steam boiler to remove the scale? *A.*—We should not recommend its use for that purpose. It would contain impurities that might be injurious to the boiler.

(267) H. M., Hamilton, Ohio, writes: I have trouble with varnish for drawings. Will you tell me how to make a nearly white varnish? *A.*—There are several varnishes used for the purpose. Our practice has been to use white shellac cut with alcohol. The shellac, as well as the alcohol, must be of good quality. Only a moderate amount of shellac is required. You can by trial find when a sufficient amount has been cut. Apply with a soft brush. Keep the varnish closed tightly when not in use.

(268) Western, Adrian, Mich., asks: 1. Is it not injurious to a boiler to set it so that there is 4" space on each side at the water line, and arch over the top leaving 6" to 10" space between shell and boiler for the entire length, except about 12" at back and front? *A.*—We have never had experience with boilers set in this way. It is advocated by some engineers, and the question of whether it will injure the shell above the water line must be settled by experience. 2. Did you ever know the instance of a long line of 2½" shafting to be hung on pointed screws through jaws with the opening down, and nothing but the points of the screws to hold the shaft from falling; this where men are constantly employed underneath it, and power taken off all along the line, and would you advise putting it up in this way? *A.*—We have no recollection of seeing long lines of heavy shafting put up in such hangers, and think we should prefer hangers of some other kind, under the circumstances. If the open part of the jaw were up, it would be less objectionable.

(269) F. C. D., Granby, Mo., asks: 1. What is the highest practical speed at which a No. 7 Sturtevant blower can be run? *A*—You can obtain the most satisfactory information by writing to the manufacturers. 2. Suppose I drive two plugs into holes of the same diameter in a boiler, one of these plugs being tapered to a point inside the boiler and the other full size on the end, which one will be blown out with the least pressure? *A.*—Other things being equal, there will be no difference. 3. Why is a cast-iron hollow shaft stronger than a solid one? *A.*—If of the same diameter, it is not so strong. If of the same weight, it may be stronger because the metal is likely to be denser, and because the metal is better distributed to resist strains. 4. In turning wrought iron, why can it be turned smoother with water than dry? *A.*—The water acts as a lubricant. 5. I have a direct-acting steam pump, pumping water 100 feet high. The area of the discharge valve is 16 inches. Which would be best, a 4-inch or a 6-inch discharge pipe? *A.*—You neglect to give size of pump and speed at which it is run. On general principles, the larger the discharge pipe the less the friction of the water, and the easier the pump will work. 6. What is meant by saying that a boiler is tested to 150 lbs., hammer test. *A.*—Such an expression would have no meaning. You probably mean hydraulic, or water test.

(270) A. W., Providence, R. I., asks: 1. In testing boilers by hydrostatic pressure, how much above the working pressure are they tested by U. S. inspectors? *A.*—50 per cent. 2. Are Fairbairn's rules for safe working pressure used? *A.*—Not exclusively. 3. Can you give me a rule for the strength of both iron and steel boilers? *A.*—The strength of a boiler depends upon the kind of boiler, the tensile strength of the material of which it is made, the manner in which it is braced, whether the holes are punched or drilled, etc. You will find the matter discussed in works treating on boiler construction, to which we refer you, since no specific answer can be given to a question so general in its character.

(271) P. T. B., Brooklyn, N. Y., writes: Will you tell me of what material and of what size can I make an electric battery to have power enough to ring a small bell or to work a telegrapher's relay? *A.*—You can make a very simple form of battery with common drinking glasses. Put in each glass a strip of copper and a strip of zinc, about 1¼" wide and long enough to stand clear of the top of the glass. Fill the glasses to within an inch of the brim with dilute sulphuric acid. Connect the copper and zinc strips alternately by wire; that is, connect the copper in one glass with the zinc in the next till the circuit is complete. You can buy a battery from any electrician, that would answer your purpose, for about one dollar.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

James W. See, Consulting Engineer, Hamilton, O.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

How to reach 40,000 prominent "*Steam Users*" in the United States. Send for our circular. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Castings furnished for 18" and 21" swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Patents and Engineering.—E. P. Robbins, M. E., Cincinnati, O., mechanical engineer and expert, patent solicitor and expert. ☞ special attention given to perfecting inventions

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

Speed and drill lathes, 10"x4', new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Reed's Sectional, Removable Steam Pipe and Boiler Covering. Send for circular and prices to C. C. Cowpland & Co., No. 744 Broadway, New York, agents for the States of New York and Northern New Jersey.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn st., Chicago, Ill.

MANUFACTURES.

The Cleveland (Ohio) City Forge & Iron Co. have recently placed a 60" swing lathe made in Scotland.

The B. W. Hoyt Manufacturing Co., Epping, N. H., propose erecting a new shoe factory, 40x216 feet.

The St. Louis (Mo.) Gas, Fuel and Power Company has just purchased a thousand tons of pipes, to be laid at once.

The Canada Pacific Railway Company is about to build a car shop and planing mill at Winnipeg, Manitoba, that will cost $120,000.

The works of the Leader Sewing Machine Co. are under way at Cleveland, Ohio. The motive power will be a Westinghouse engine.

The Boston and Albany Railroad have placed an order with the Damascus Bronze Company, of Pittsburgh, Pa., for 40,000 lbs. of ingots.

C. C. Cowpland & Co., 744 Broadway, New York, have just accepted the agency for Reed's pipe and boiler covering, and intend to push its sale.

The Seth Thomas Clock Co., Thomaston, Conn., are to add watches to their line of manufacture, and a four-story building, 150 feet long, is to be at once erected.

William A. Harris, the well-known builder of the Harris-Corliss engine, at Providence, R. I., is building a new blacksmith shop, 44x45 feet; also a storehouse, 170x40 feet.

A meeting of the stockholders of the Rochester Car Wheel Works is to be held in Rochester, N. Y., on August 3, with a view of increasing the capital stock from $25,000 to $60,000.

W. H. Warren, Worcester, Mass., is manufacturing an improved radial drill, in which the spindle is balanced in all positions from a vertical to a horizontal without any adjustments being required.

A new company is organizing at Foxboro, Mass., to build a patent self-oiling axle, said to be a good thing. Capt. A. J. Nichols and F. Williams, of Foxboro, are among the prime movers.

The Chattanooga (Tenn.) Cooperage Company, recently organized for the erection of a factory to manufacture kegs and boxes, have decided to build, in connection with the latter, a larger factory to manufacture buckets and tubs.

George M. Griswold, New Haven, Conn., has been enlarging his business by adding tools to meet the demands of large contracts for covering boxes with paper (paper boxes). Is also driven with business on making his improved match machinery.

The Craig Double-Sight Lubricator Co., Lawrence, Mass., have been placing improved tools for manufacturing the lubricator illustrated in the AMERICAN MACHINIST of July 7. They have orders ahead to keep them busy for six weeks, and propose to put in still more tools.

The preliminary steps have been taken to establish at Newport News, Va., extensive fertilizer and chemical works, the latter for the production of sulphuric acid from iron pyrites, which abound along the line of the Chesapeake and Ohio Railroad—the supply being, it is said, inexhaustible and rich in sulphur. The effect of these works will be to reduce the price of fertilizers by cheapening the cost of the acid, which is one of their principal constituents.

The *Herald-Democrat*, of Leadville, Col., says: It has long been realized that the facilities for treating the ores produced in this district were entirely inadequate, and, as a result of this, a new smelter is about to be provided under a co-operative system. Several meetings have been held in reference to the scheme, and the conferences have been most satisfactory. At least one million dollars will back the enterprise, and it is expected that work will begin very shortly.

Mr. Walker, of the Walker Manufacturing Company, Cleveland, Ohio, has been around Eastern shops, looking after the purchase of heavy machinery for use in the works. He reports the firm busy getting out plant for electric stations belonging to the Brush Electric Company. In one station they are putting in four 500-horse power engines, with all the connecting machinery. They make a specialty of pulleys and shafting.

The Harrison Boiler Works, Philadelphia, Pa., have been having tests made of their boiler by Prof. Morton, of the Stevens Institute of Technology. In his preliminary report Prof. Morton informs the company that they can safely guarantee an evaporation of 9 lbs. of water into high-pressure steam for each pound of coal burned, and that under all conditions the steam is completely dry, showing a slight amount of superheat. In regard to capacity as compared with rated size, a 50-horse power boiler developed (on a basis of 30 lbs. of water) from 64 to 75-horse power, varying with the kind of coal used. Neither of the coals used showed less than 16 per cent. of refuse. The evaporation during the capacity tests above referred to was, per pound of coal, from 9.25 to 9.93 lbs. and per pound of combustible, from 11.04 to 12.5 lbs. of water. The feed water was heated to 212°, and the pressure under which the water was evaporated was about 70 lbs. per square inch. In a test with a blower, the 50-horse power boiler developed 137-horse power.

Machinists' Supplies and Iron.

NEW YORK, July 26, 1883.

There is no noteworthy change in the general supply business, but the hopeful feeling regarding fall business is having a good effect on manufacturers.

In iron the transactions are quiet and moderate in extent. We quote standard brands of American Pig: No. 1 X Foundry, $22.50 to $23 for prompt delivery; No. 2 X, $19.50 to $20.50; Grey Forge, $17.50 to $18.50. The arrivals of Scotch Pig have been large, but have not materially affected prices. We quote: Coltness, $24 to $24.50; Glengarnock, $22.50 to $23; Gartsherrie, $24; Summerlee, $23 to $23.50; and Eglinton, $21 to $21.50.

Antimony is in light demand, the demand being for jobbing purposes. Holders' prices are 9¾c. for Hallett's, and 10⅜c. for Cookson's, but lower prices are accepted.

In Copper prices are 15c. to 15⅛c. for Lake, and 14c. to 14¼c. for Baltimore and other brands.

The market for Pig Tin has developed considerable activity. In jobbing lots Banca is held at 22½c.; Straits and Malacca and Billiton, 22c.

Spelter sells at 4.40c. and 4.70c. for Domestic; Refined, 8c. to 8¾c.; Silesian, 5c. to 5½c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Wanted, Tool Maker—A good workman can find permanent employment. Joel Hayden Brass Company, Lorain, O.

Wanted—A first-class pattern maker. Steady work to right man. Address, Birmingham Iron Works, Birmingham, Ala.

Wanted—An agent in every town to sell a new machinist's tool. Liberal terms. Machinists preferred. Address, A. Barbour, Tarentum, Pa.

Wanted—25 machinists, "live men," to work on duplex steam pumps, in one of the best arranged shops in America. Apply to The Gordon & Maxwell Company, Hamilton, Ohio.

Situation Wanted—In a small machine shop, by a young draughtsman, where he could have an opportunity to obtain an interest in the business. Address, Interest, AMERICAN MACHINIST office.

A mechanical draughtsman, with shop experience, desires position. Steam engine work preferred. Address, Swede, 1049 Superior street, Cleveland, O.

Wanted—A first-class foundry foreman. Must be a good workman. To the right man it will be a steady job. Four dollars a day at first, and more as he makes the foundry profitable. Address, Birmingham Iron Works, Birmingham, Ala.

Wanted—One or two good tool makers. Only experienced men (who understand the importance of close fitting, and *can do it*) need apply. State wages and give reference.—Trump Bros. Machine Company, Wilmington, Delaware.

Wanted—By an old and well-established machine shop in Southern Pennsylvania a first-class mechanical engineer and draughtsman who has had long practical experience in designing and building automatic cut-off engines, steam boilers and portable engines of various kinds, also other machinery; must be a good designer generally, and furnish the best of references both as to character and efficiency. Address Box 9, care AM. MACHINIST, 96 Fulton street, New York.

Wanted—A No. 2 second-hand Root Blower. Tozer & Dial, Columbia, S. C.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N. J.

Wanted—A partner with about $5,000, in a small machine shop and foundry within 10 miles of New York. A mechanic preferred. Address, Box 2, AM. MACHINIST.

For Sale—The patents, tools and gauges for manufacturing an adjustable drill chuck holding from 0 to ⅜. The strongest-holding, most durable and reliable drill chuck in the market. Address, Box 744, New Haven, Conn.

For immediate delivery, 16″, 18″, 25″ and 26″ swing engine lathes from new patterns, combining all the best improvements, at exceedingly low prices. For cuts and prices, address J. B. Reed, Cairo, Ill.

Horizontal boring machine, second-hand, wanted—one of Bement's No. 2 size preferred, in good condition. In reply state price, how long in use, and cost of packing and delivery to New York or Boston. Address, G. R., care AM. MACHINST.

For Sale—Foundry, machine and blacksmith shops in the most live town in Southwest Iowa. Good shipping to Kansas, Nebraska and Missouri. Manufacture steam engines, house and railroad castings. Only small capital needed. Terms easy. Address, Iowa, care AM. MACHINIST.

The Soho Foundry and Machine Works, Toronto, Canada, for sale. These works, which are the best located in Toronto, being just opposite the Union Station and not 100 feet from the water, offer a rare opportunity for any manufacturer desirous of doing business in Canada. For full information apply to Geo. F. Bostwick, Trustee.

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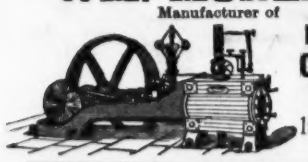
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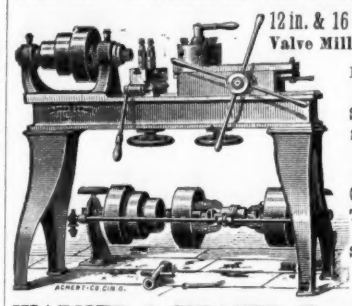
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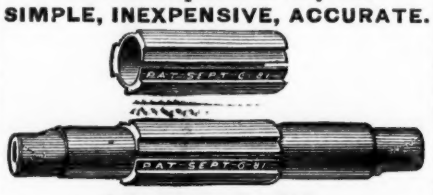
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HARTFORD, CONN. U.S.A.
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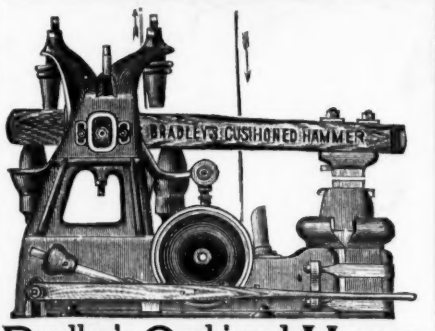

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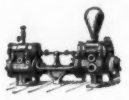
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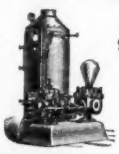
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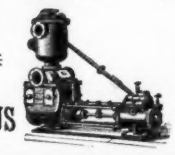
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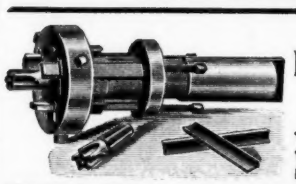
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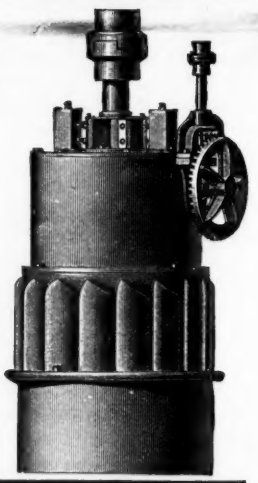

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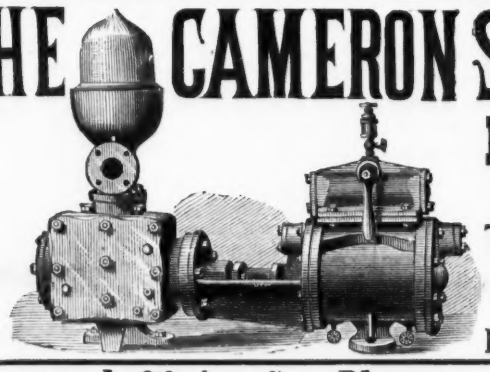
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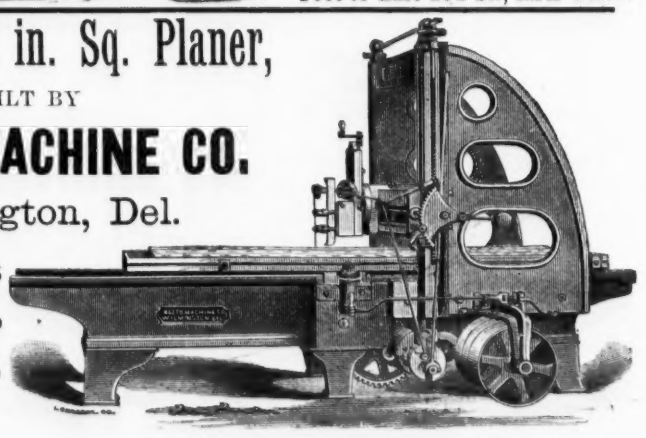

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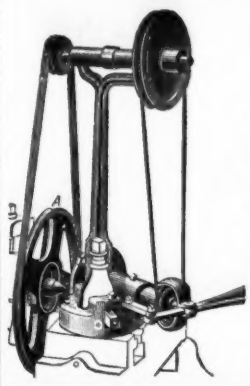

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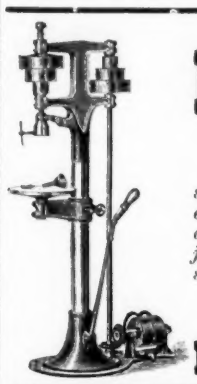

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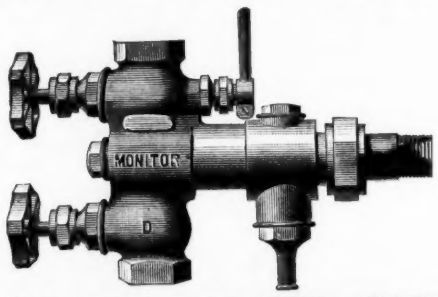

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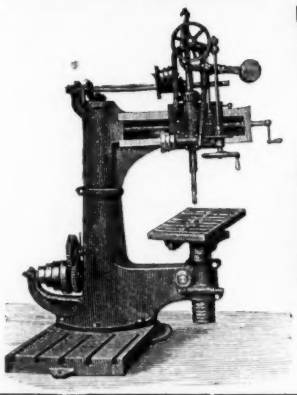

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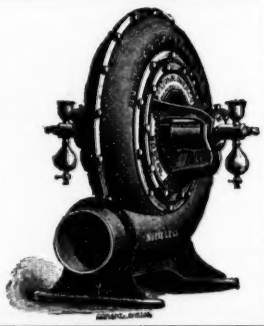

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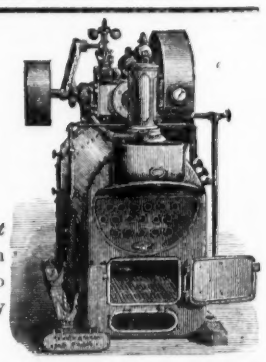

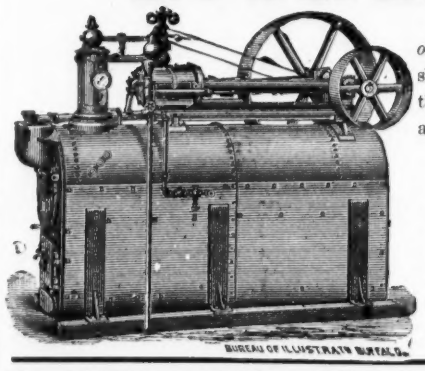

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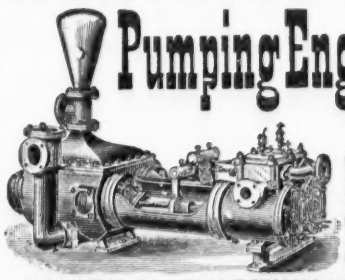

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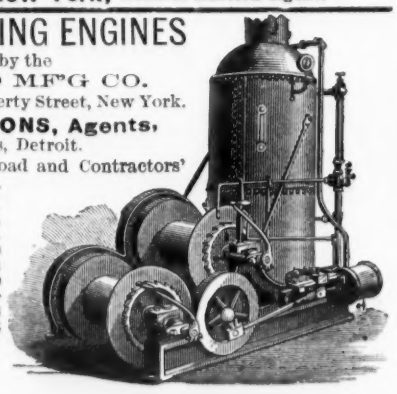

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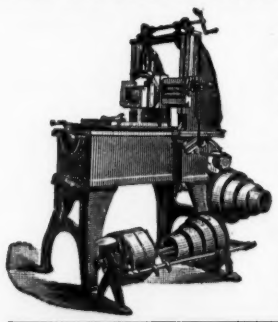

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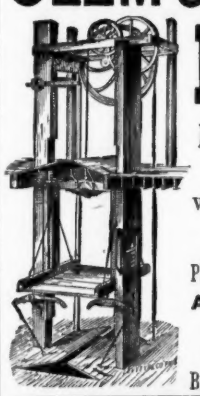

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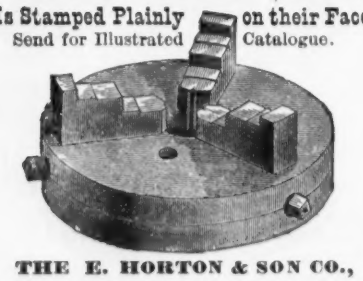

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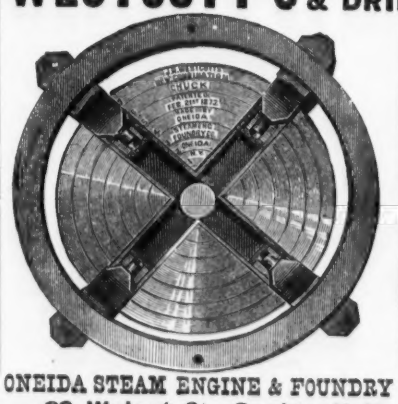

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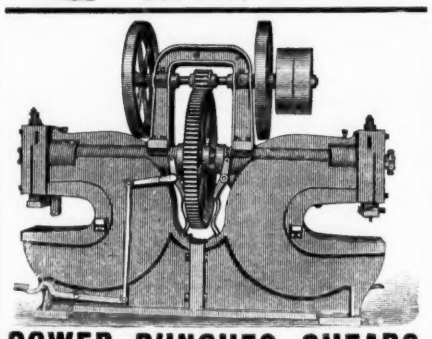

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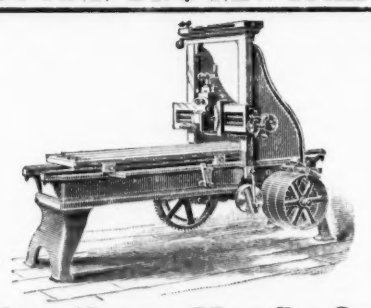

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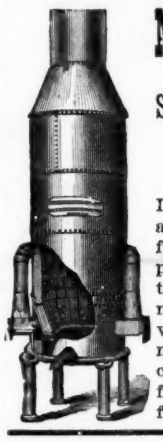

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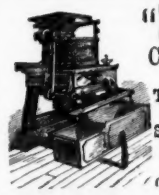

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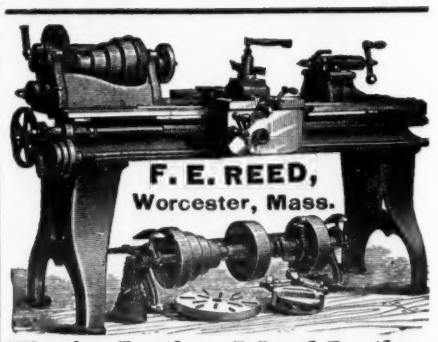

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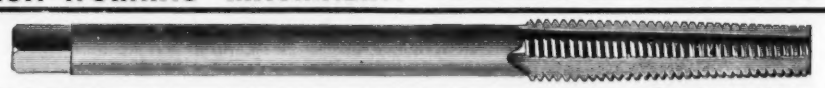

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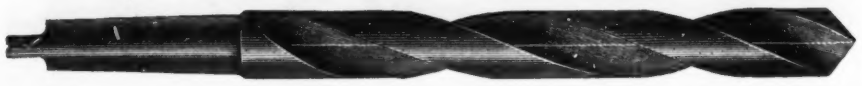

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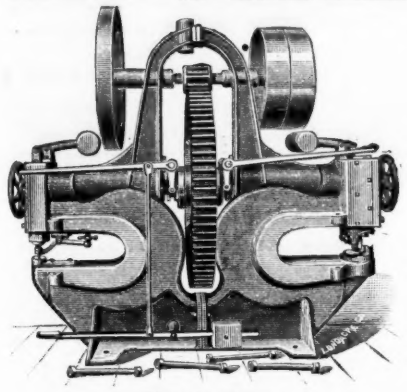

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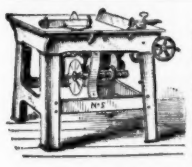

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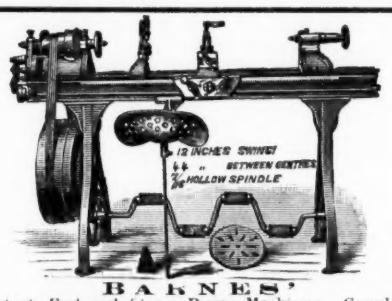

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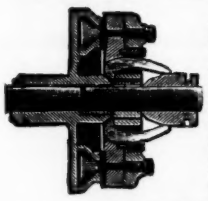

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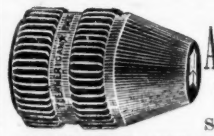

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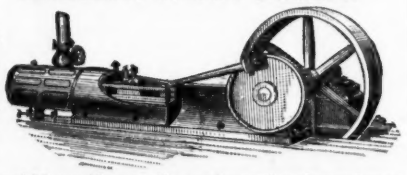

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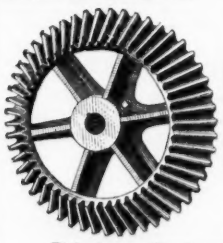

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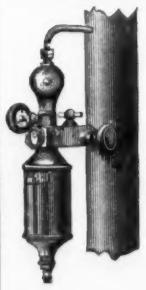

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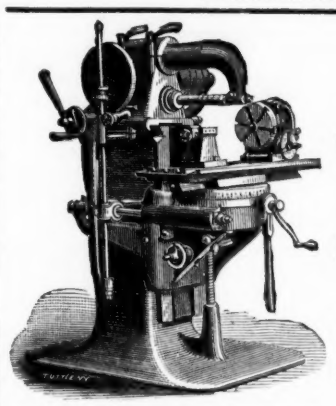

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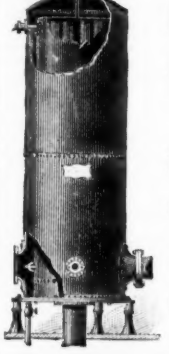

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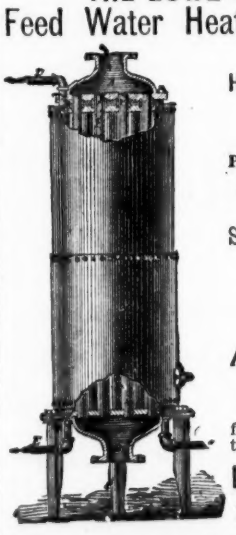

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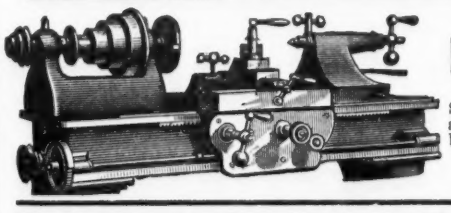

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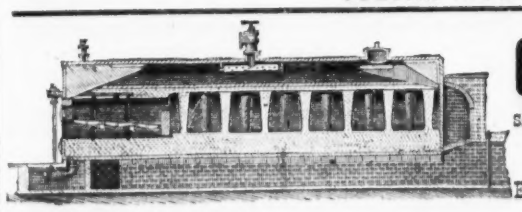

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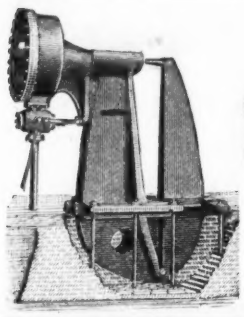

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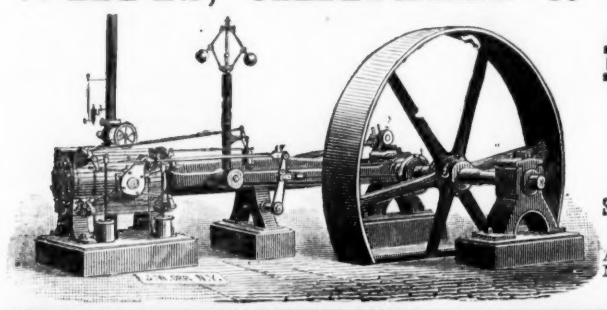

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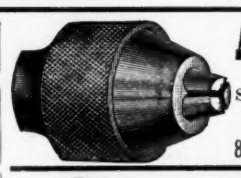

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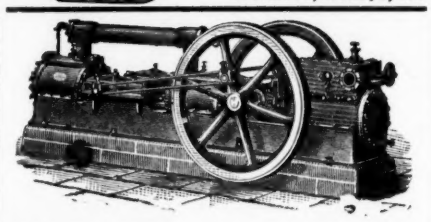

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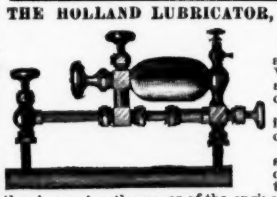

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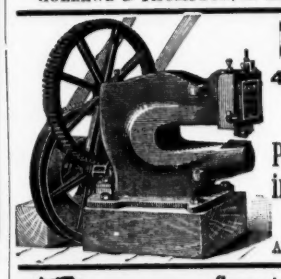


ROBERT KENT,

45 to 49 Jay St.

BROOKLYN, N. Y.

Manufacturer of

Punching, Shearing and Riveting MACHINES,

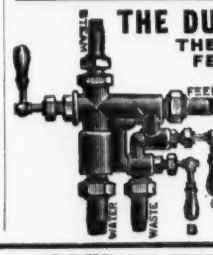
Also, Plate Bending Rolls.

Superior 10, 12 & 16 in.

SPEED LATHES.

Built by RAY & SCOTT, DEXTER, MAINE.

Send for Description.



THE DUPLEX INJECTOR,

THE BEST BOILER FEEDER KNOWN.

Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

JAMES JENKS,

Detroit, Mich.

DREDGES.

guaranteed to excavate 50 per cent. more material from hard bottom than any other machine.

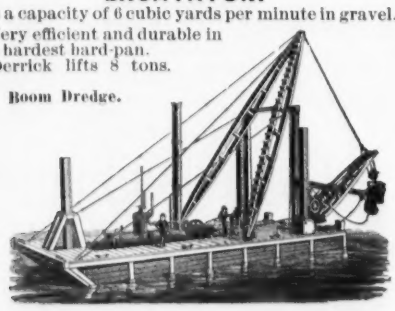
EXCAVATOR.

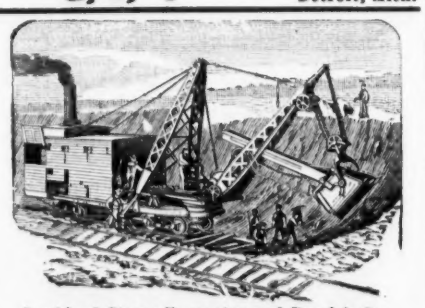
has a capacity of 6 cubic yards per minute in gravel.

Very efficient and durable in the hardest hard-pan.

Derrick lifts 8 tons.

Boom Dredge.





Combined Steam Excavator and Derrick Car.

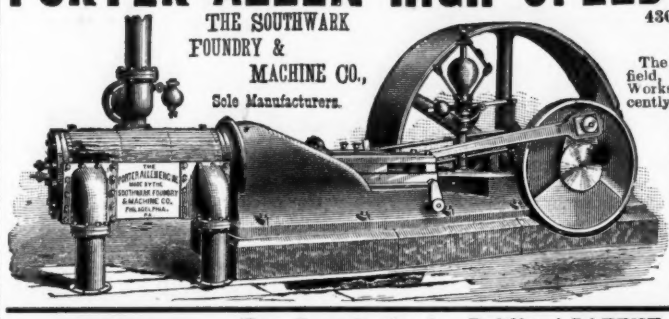
OSGOOD & MACNAUGHTON,

ALBANY, N. Y., Patentees,

Successors to RALPH R. OSGOOD, Troy, N. Y.

PORTER-ALLEN HIGH SPEED ENGINE.

430 WASHINGTON AVE., PHILADELPHIA



THE SOUTHWARK FOUNDRY & MACHINE CO., Sole Manufacturers.

The Springfield Iron Co., Springfield, Ill., and The Otis Steel Works, Cleveland, Ohio., each recently ordered their THIRD Porter-Allen Engine. The Cambria Iron Co., Johnstown, Pa., have put in, during the past year, their EIGHTH Porter Allen Engine, being 100 H. P. to run electric lights. The first Porter-Allen plant put in these works, six years ago, for rolling mill purposes, with same boilers and engines relatively equivalent to the former, doubled the output of the Works.

For Superiority in Drilling Soft or Hard, Thin or Thick Metals use the **PATENT FLUTED DRILL.**

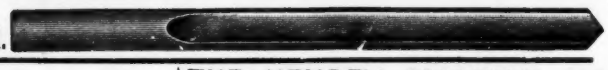
For Lathe Work it is unexcelled. In boring, counterboring, reaming, or to countersink, the highest testimonials are given. Made by UNION TWIST DRILL CO., 96½ SUMMER STREET, BOSTON, MASS., Agents for

Cage's Self-Tightening Drill Chuck.

S. A. SMITH, Agent for the West, 154 LAKE ST., CHICAGO, ILLS.

Holds from 0 to ½ and 0 to ¾.

No Key or Wrench required.



Fox, Turret and Speed Lathes

—AND—

Swivel Head Engine Lathes,

(18 and 26 in. from new patterns.)

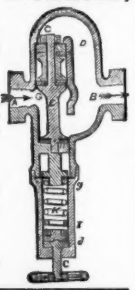
GEORGE GAGE, WATERFORD, N. Y.

Ross Fluid Pressure Reducer,

FOR

Steam, Water, Air and Gas.

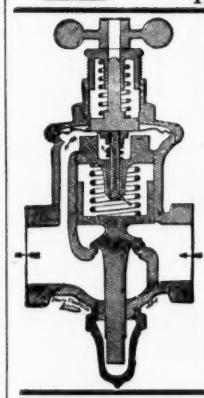
Automatically reduces the pressure in pipes to any desired extent.



ROSS VALVE CO.

652 RIVER ST.

TROY, N. Y.



CURTIS

Pressure Regulator

For Steam, Water and Air,

MANUFACTURED BY

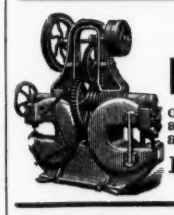
Curtis Regulator Co.

51 BEVERLY ST.,

Boston, - - Mass.

GENERAL AGENCIES:

109 Liberty St., New York.
925 Market St., Phila., Pa.
80 Market St., Chicago, Ill.
Cor. Holliday and Saratoga Streets, Baltimore.



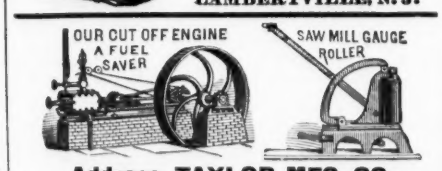
FOR A COMBINED

Punch and Shears

of beautiful design, of great strength and capacity, and thoroughly reliable, address

Lambertville Iron Works,

LAMBERTVILLE, N. J.



Address, TAYLOR MFG. CO.

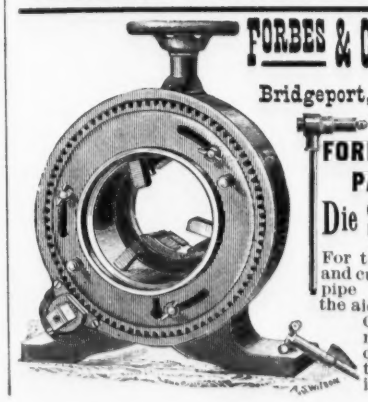
(Please Mention this Paper.) Chambersburg, Pa.

WORCESTER MACHINE SCREW CO.

AND 111 LIBERTY ST. NEW YORK

MANUFACTURERS OF

STANDARD MACHINE SCREWS.



FORBES & CURTIS,

Bridgeport, Conn.

M'f'r's of

FORBES' PATENT

Die Stocks,

For threading and cutting off pipe without the aid of vise. Only one man required to thread 6 in. pipe.

THE HENDEY MACHINE CO.

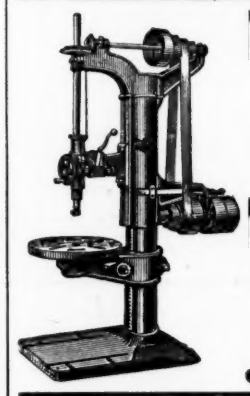
TORRINGTON, CONN.

15, 24 and 30 in. Shapers.

4 ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 6 ft. x 26 in., 8 ft. x 26 in. and 8, 10, and 12 ft. x 30 in. Planers.

5 ft. x 12 in., 6 ft. x 12 in., 6 ft. x 15 in. and 8 ft. x 15 in. Hollow Spindle Hand Lathes.

AMATEURS' HAND PLANERS, SHAPER AND PLANER CENTERS, SLIDE RESTS, &c.



UPRIGHT DRILLS

16 to 60 Inches Swing.

BORING AND TURNING MILLS

To Swing, 48, 66 & 84 in.

H. BICKFORD,

Cincinnati, Ohio.

P. BLAISDELL & CO.,

Manufacturers of

Machinists' Tools,

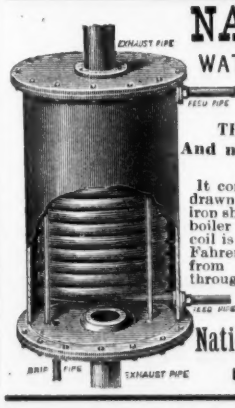
WORCESTER, MASS.

VOLNEY W. MASON & CO.

Friction Pulleys, Clutches and Elevators

PROVIDENCE, R. I.

NATIONAL FEED WATER HEATER



THE CHEAPEST, BEST And most Effective Heater In the Market.

It consists of a coil of seamless drawn brass tube contained in an iron shell. The feed water for the boiler passing through the brass coil is heated up to 212 degrees Fahrenheit, by the exhaust steam from the engine, which passes through the shell.

Circular and Price List sent on application.

National Pipe Bending Co.

New Haven, Conn.

"OTTO" GAS ENGINE.

OVER 8000 IN USE.

Manufactured by

SCHLEICHER, SCHUMM & CO.,

23d and Walnut Streets, Philadelphia.

THE HARTFORD AUTOMATIC CUT-OFF ENGINE.

Built for Heavy and Continuous Work, and adapted to any required speed.

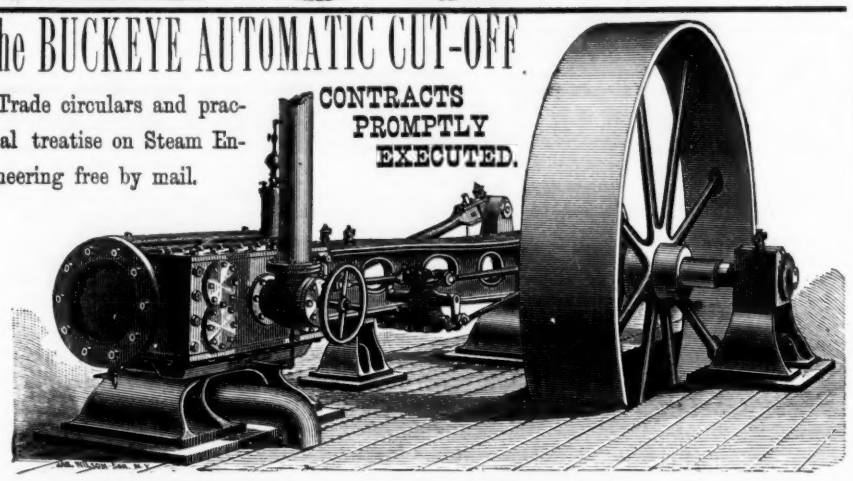
Close regulation and best attainable Economy of Fuel. Circular and Practical Treatise on Steam Engineering sent on application.

THE HARTFORD ENGINEERING COMPANY,
HARTFORD, CONN.
New York Office,
Rooms 72 and 73, Astor House.

The BUCKEYE AUTOMATIC CUT-OFF

Trade circulars and practical treatise on Steam Engineering free by mail.

CONTRACTS PROMPTLY EXECUTED.

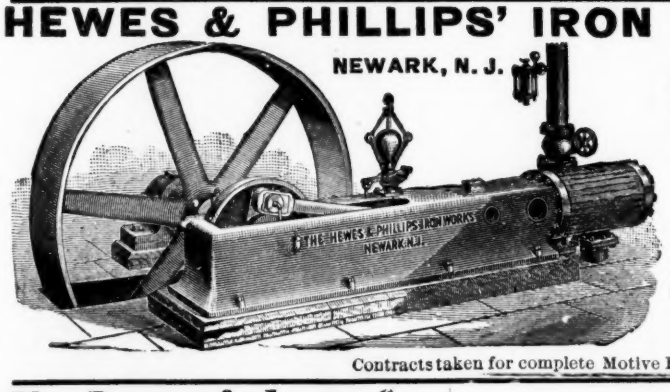


These Engines are carefully constructed for heavy and continuous duty, at medium or high rotative speeds. Highest attainable economy in consumption of steam, and superior regulation guaranteed.

Address, BUCKEYE ENGINE CO., Salem, Ohio.

HEWES & PHILLIPS' IRON WORKS,

NEWARK, N. J.



Manufacturers of

The ALLEN PATENT HIGH-SPEED ENGINE.

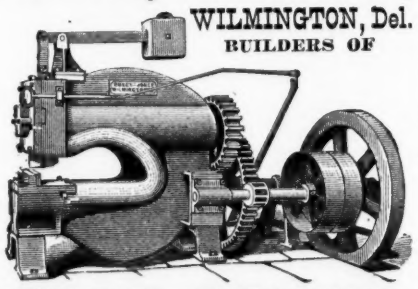
Both Condensing and Non-Condensing. High economic duty and fine regulation guaranteed.

Tubular Boilers and Steam Fittings.

Contracts taken for complete Motive Power Outfits.

The Pusey & Jones Co.,

WILMINGTON, Del.
BUILDERS OF



STEAM ENGINES,

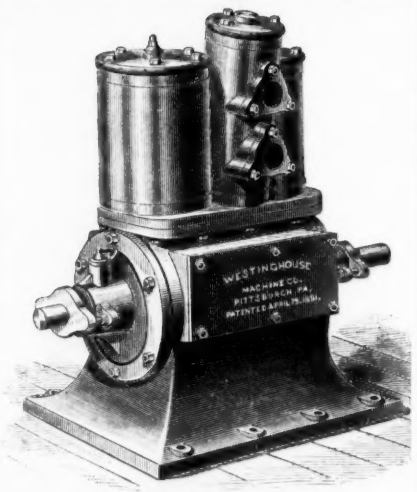
Boilers, Tanks, Machinery for Rolling Mills, Punches, Shears, Riveters, Angle Iron Cutters, Cranes, and heavy Iron Work generally.

Iron Working Machine Tools

42 in. x 16 ft. and 20 ft. Triple Geared Engine Lathe. Ames. New.
36 in. x 18 ft. Engine Lathe. Fifield. New.
24 in. x 10, 12, 14 & 20 ft. Engine Lathe New. Ames.
24 in. x 10 in. x 12 ft. Engine Lathe. Fifield. New.
20 in. x 8, 10, 12 and 14 ft. " " Ames. New.
20 in. x 8 ft. Engine Lathe, Fifield.
20 in. x 10 ft. Lincoln Engine Lathe. Good order.
17 in. x 8 ft. " " " " " "
16 in. x 6, 7, 8, 10 and 12 ft. Engine Lathe Bridgeport.
1 13 in. x 4 ft. Engine Lathe, Rod Feed. P. & W. Good order.
27 in. x 27 in. x 6, 7, 8 ft. Planers. Ames. New.
26 in. x 26 in. x 7 ft. Planer. Brettell. New.
24 in. x 27 in. x 6, 7 and 8 ft. Planer. Ames. New.
22 in. x 22 in. x 5 ft. Planer. Ames. New.
16 in. x 16 in. x 42 in. " Bridgeport. New.
12 in. Stroke Crank. " Belden. Second-hand.
9 in. Stroke Shaper. Hewes & Phillips. New.
15 in. and 24 in. Stroke Shaper. Hendey. "
10, 15 & 20 in. Stroke Shaper. Gould & Eberhardt.
42 in. Radial Drill. Box. New.
16, 20, 22, 26, 30 and 36 Upright Drills. Prentice. New.
2, 3, 4 and 6 Spindle Gang Drill. 2ndhand. P. & W.
No. 2 Lincoln Pattern Milling Machine. Ames. New.
No. 2 Screw Machine, wire feed. Secor. New.
No. 1 Square Arbor Fox Lathe. Am. T. & M. Co.
No. 2 Cabinet Turret " "
One 12 in. x 12 in. Vertical Engine. N. Y. S. S. Pow. Co. Second-hand.

New York Agent,
Brown & Sharpe Manufacturing Co.
Bradley Hammers.
Write full particulars of what is wanted.

E. P. BULLARD,
14 DEY ST., N. Y.



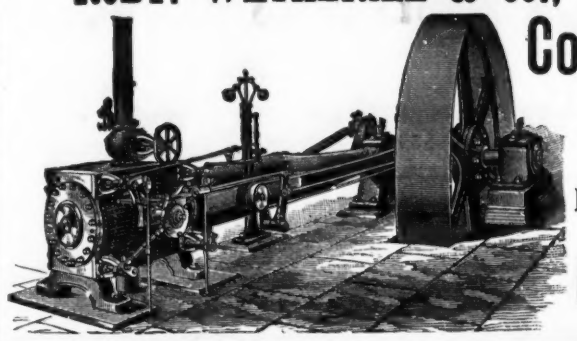
THE
Westinghouse Engine

Partial List of Sales for June, 1883.

	H. P.
Allegheny County Light Co., Pittsburgh, Pa	125
WaterWks, Council Bluffs, Ia., Centrifugal P'mps.	100
" " " " " "	100
R. H. Brown & Co., New Haven, Ct., Mach'ts	100
H. I. Proctor, Ogdensburg, N. Y., Planing Mill	100
Fred. Oliver & Co., Charlotte, N. C., Oil Mill	65
Hitchcock & Bradley, Bend'g Co., Ashtabula, O.	65
Leader Sewing Machine Co., Cleveland, O.	65
N. Y. & Brooklyn Elect. Lt. Co., N. Y. City	50
T. A. Wilson, Reading, Pa., M'f'r Spectacles	30
G. Merz, Chicago, Ill., Cigar Boxes	25
C. N. Nelson Lumber Co., St. Paul, Minn.	25
Emma Oil Co., Pine Bluff, Ark	18
Davis Church Organ Co., Buffalo, N. Y.	18
Cole Bros., Canby, Oregon	18
James Gage, Rockland, N. Y.	18
Central Mfg. Co., Montgomery, Ala	12
John Bain, Toronto, Canada	12
W. H. Reed & Co., Chillicothe, O., Planing Mill	12
Green & Clay, Waxahachie, Tex	10
B. Frank Mohr, Mifflinburg, Pa	8
H. L. Smith, Montgomery, Ala	8
Carrow, Bishop & Co. Philadelphia, Pa. Jewelers.	8
Louis Cook Carriage Co., Cincinnati, O.	8
General Rosser, Minneapolis, Minn., Yacht	8
A. C. Rand, " " " "	8
Post & Co., Cincinnati, O.	4
San Antonio "Express," San Antonio, Tex.	4
Total H. P.	1,024

The Westinghouse Machine Company,
PITTSBURGH, PA.

ROBT. WETHERILL & CO., CHESTER, PA.



Corliss Engine Builders,

Condensing, Non-condensing, and Compound.

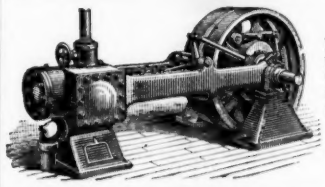
HIGHEST EFFICIENCY AND GREATEST ECONOMY.

Boiler Makers.

Hydraulic Riveting.

LAMBERTVILLE IRON WORKS.

A. WELCH,
Manufacturer of
Patent Automatic
CUT-OFF
Steam Engines
Lambertville, N. J.



STRAIGHT LINE AUTOMATIC CUT-OFF ENGINE;

Medium or high speed; uniform at all ranges of power or steam pressure; the fewest parts and working joints; the best material correctly distributed, and unexcelled in workmanship, balance, and smooth running.

For Eastern and Southern States, apply to the
Straight Line Engine Co., Syracuse, N. Y.
For the West and South-West, to the
M. C. Bullock Manufacturing Co., Chicago, Ill.

SCHUTTE & GOEHRING, Manufacturers.
THE KORTING EXHAUST-STEAM-INDUCTION CONDENSER.

Always reliable. Send for circular.

Will lift water without any pump. Operates equally well when supply flows to condenser from one foot fall or more. Requires no hot well, no elevated tail pipe, or tank. The most satisfactory results obtained.

OFFICES AND WAREROOMS:
12th & Thompson Sts. Phila. | A. Aller, 109 Liberty St. N.Y. | Jarvis Eng. Co., 7 Oliver St. Boston.

New & Second-Hand Machinery.

JULY 24, 1883.

1 Engine Lathe, 14 in. x 6, 7 & 8 ft. Grant & Bogert.
1 each " " 26 in. x 9, 12 & 14 ft. Grant & Bogert.
1 " " 45 in. x 15 ft. Good Order. [New
1 " " 36 in. any length of bed.
1 " " 15 in. x 6 ft. New
1 " " 14 in. x 5 & 6 ft. "
1 " " 16 in. x 6, 7 & 8 ft. "
1 " " 18 in. x 8 & 10 ft. Lodge & Barker "
1 each Engine Lathes, 20 in. x 10 and 12 ft,
1 " " 24 in. x 10 ft. New.
1 " " 28 in. x 18 ft. New.
1 " " 24 in. x 12, 14 and 16 ft. New.
1 " " 11 in. x 4 ft. & 5 ft. Prentiss. New.
1 each. Plain Engine Lathe. 16 in. x 4 ft., & 6 ft. "
1 15 in. x 4 ft. Turret Lathe. Lodge & Barker.
1 13 in. x 4 ft. Turret Lathe.
1 Fox Turret Lathe, 16 in. x 6 ft. Lodge & Barker. New.
1 Planer, each 24 in. x 24 in. x 5 x 6 ft. Second-hand.
1 " 22 in. x 20 in. x 5 ft. new
1 " 24 in. x 24 in. x 6 ft. Hendey. "
1 " 26 in. x 26 in. x 7 ft. "
1 " 30 in. x 30 in. x 8 ft. 2nd Hand.
1 " 36 in. x 36 in. x 10 ft. Good Order.
1 16 in. Lever Table Drill. New.
1 each 16, 20, 22 & 24 in. Upright Drills. Prentiss.
1 19 in. Upright Drill. Blaisdell.
1 each 25, 28 & 34 in. B. G. & S. F. Dril's. Blaisdell.
1 each 9, 12 and 18 in. Shapers. Prentiss.
1 each 10 and 15 in. Shapers. Gould & Eberhardt.
1 each 15 & 24 in. Shapers, Hendey. New.
Full assortment Milling Machines, Spindle Drills. &c., of Garvin's.
1 each Nos. 2 & 4 Screw Machines, Wire Feed, Jones & Lamson.
3 No. 2 Lincoln Millers. Good order
2 No. 2 Lincoln Millers. New.
1 Hand Lathe, 12 x 4, 5 and 6 ft. New.
1 Hand Lathe, 16 in. x 6 and 7 ft. New.
1 Boring and Turning Mill, 72 in. 2 Heads. New.
1 Boring and Turning Mill, 50 in. New.
1 Horizontal Boiler, 4 ft. x 14½ ft. Good Order.
1 Pond Index Miller.
1 Cutting-off Machine to take sizes to 5 in.
1 Gray's Screw Machine, to take all sizes to 1 in.
1 2-Spindle Edging Machine. Good order.
1 each 3 and 7 Spindle Nut Tapper.
All kinds Machinists' Small Tools and Supplies.

NEW YORK AGENCY OF THE TANITE CO., AND FOR THE "NEW POLISHED" SHAFTING.
H. PRENTISS & COMPANY, 42 DEY ST., N. Y.

CRAIG'S HYDRAULIC GOVERNOR,

FOR STEAM ENGINES,
The Most Perfect Governor Known.

RUNS IN OIL.

Guaranteed to accurately regulate all classes of engines.

Illustrated and descriptive Catalogue sent on application. Correspondence solicited.

W. H. CRAIG & CO.
Sole Manufacturers,
LAWRENCE, MASS.

E. G. FELTHOUSEN, Buffalo, N. Y.

Manufacturer of
Patent Automatic & Hand Cylinder Oil Pump,
Flue Cleaners, Gauge Cocks, Ratchet Drills, &c. Specialties in Engine Supplies.

The most reliable Oiler in the market.
C. M. MORSE, Eastern Agent, 12 Cortlandt St., N. Y.

S. ASHTON HAND,

Toughkenamon, Chester Co., Pa.,
MAKER OF FIRST-CLASS
ENGINE LATHES

Is now in position to put on the market
14" ENGINE LATHES OF NEW DESIGN
guaranteed to be equal in material, design and workmanship to the best ever offered.

SHAPING MACHINES.

6 in. and 8 in. Hand and Power.
SEND FOR CIRCULAR.
BOYNTON & PLUMMER, Worcester, Mass.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:

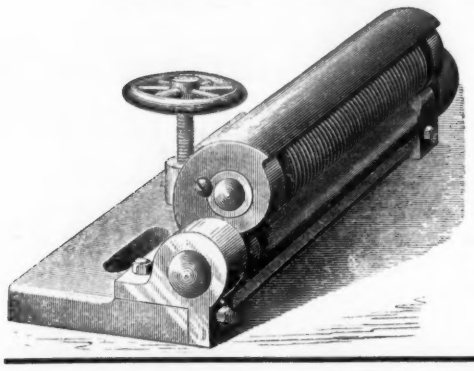
One Planer to plane 61 in. x 61 in. x 20 ft. long.
One Planer to plane 54 in. x 54 in. x 16 ft. long.
One Planer to plane 15 ft. long 51" wide very good.
One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.
One Iron Planer, to plane 12 feet long, 30 in. x 30 in.
Two Iron Planers, to plane 5 ft. long, 24 in. x 20 in.
One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.
One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.
One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.
One Combined Power Punch and Shears, to punch ⅝ and ⅛, and shear ½ in. iron.
Two No. 2 Pratt & Whitney Milling Machines. Very good.
One Axle Lathe, Fitchburg Machine Co.
One 12 in. Shaper, Lowell Machine Shop.
One No. 1 Brown & Sharpe Screw Machine.
Two 4 in Spindle Drills.

Send for List of New Machinery.
The George Place Machinery Co.,
121 CHAMBERS AND 103 READE STREETS, NEW YORK.

BROWN & SHARPE MFG. CO.

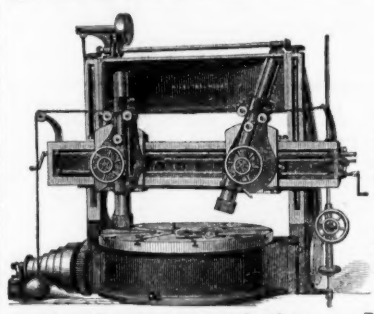
PROVIDENCE, R. I.

GRINDSTONE TRUING DEVICE.



One of the most disagreeable things to be done in a workshop is the Truing of Grindstones. It is, therefore, often the case that they are allowed to become quite out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut illustrates a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically, without interfering with the constant use of the stone, and does the truing without raising any dust

BORING AND TURNING MILLS



5, 6, 7, 8, 10, 12, 14 and 16 FEET SWING.

The Pray Mfg. Co., reports—"Can bore and turn **a Pulley 8 feet diameter, 26 inch face,** trim the edges and face the hub in 8 *hours.* Handling included."

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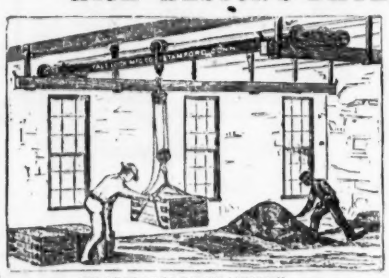

PULLEY BLOCK TRAVELER.

The bridge has longitudinal motion on the tracks, and the trolley transverse motion on the bridge, so that the load may be picked up at any point between the tracks, raised to any height, and laid down at any other point.

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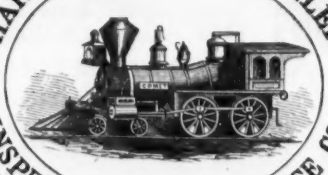

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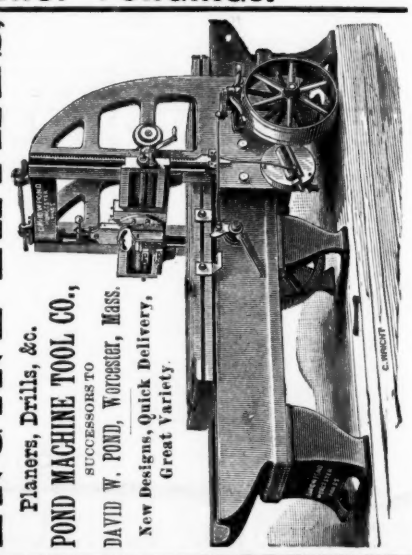

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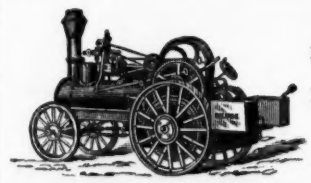

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